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Brazil's Weapons in Energy Crisis



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20 January 1982

LATIN AMERICA REPORT

No. 2435

BRAZIL'S WEAPONS IN ENERGY CRISIS

Sao Paulo O ESTADO DE SAO PAULO in Spanish 13 Nov 81 Special Energy Supplement

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ACTIVITIES FOR RESOLVING ENERGY CRISIS DETAILED

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p 2

[Special Supplement: "Brazil's Weapons in the Energy Crisis"]

[Text] Exactly 11 months remain before the beginning of the new phase in the production and consumption of energy in Brazil. In October 1982 the lake of the Itaipu Dam will be born, forming an area of water twice as large as the municipality of Campinas, to consolidate the largest hydroelectric powerplant in the world and its 12.6 million kilowatts. Meanwhile, at the opposite end of the country, the Tucuruí plant is underway, planned to be even greater. What is so much electric power going to mean for the Brazilian economy?

In the Center-South, Itaipu, in addition to the savings in petroleum, it will mean the certainty that there will be no collapse of production. In the North, Tucuruí is going to put an end to a taboo which says: "In the Amazon Region no industries are installed because of a lack of power and no hydroelectric plants are built because of a lack of consumption." Itaipu has already cost \$3.9 billion and Tucuruí, \$1.6 billion; worthwhile, but they will not be the solution to all the energy problems.

The struggle to keep power flowing is also taking place in the state of Rio de Janeiro. The fuel element manufacturing plant for the Angra I Powerplant goes into operation in Resende next year. In that complex, everything will be ready in 1984, when the country will have the first of its nine nuclear powerplants, which are scheduled up to 1995.

There is a different battle with respect to petroleum requiring an increase in production and a reduction in consumption, all at the same time so that 1985 will be reached with a daily extraction of 500,000 barrels per day, double today's production, overcoming a difficult and still mysterious geology.

There is another reinforcement for helping in this war and it comes from agriculture, where the sugarcane fields have the chance to insure sufficient amounts of alcohol. Four years remain for reaching the goal of 10.7 billion liters without harming the production of food. If the 380 plans for new distilleries were put into execution at once, there would be more than 7 billion liters by the end of 1982. However, everything will depend on the price and incentive policy.

There is an energy crisis. That is why coal is once more considered. The miners of the interior of Santa Catarina have known that since World War I, when they began to work a great deal, started up again during World War II and are beginning again now with the scarcity of petroleum. It is an alternative for the electrical, iron and steel, cement, ceramics, paper and cellulose industries.

Meanwhile, authorities and some Rio de Janeiro and Sao Paulo businessmen are seeking to convince PETROBRAS [Brazilian Petroleum Corporation] of the advantages of importing natural gas from Bolivia, guaranteeing that such purchases would save 126,000 barrels of petroleum per day. Other alternatives are beginning to flow out of the laboratories of the universities and companies: solar grain dryers, nitrogen, biodigesters, methanol, hydrogen, water lilies, liquid sewage and even garbage.

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POWER PRODUCED BY NEW POWERPLANT MAY BE SURPLUS

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[Text] Every time there is a discussion on electrical power in Brazil, the great concern is to learn how long the waterpower potential of the country can supply the domestic market. Despite the fact that the discussion is not absolutely new, the truth is that no consensus has yet been reached; there is no information which can be given as final. Each study arrives at a conclusion, the newer plans even contradict prior plans and no one knows how to say with certainty what the potential of the basins is in terms of energy.

The problem is very complex. Contrary to forecasts made within the government itself, technicians of the Ministry of Mines and Energy do not believe that Brazilian waterpower resources are being quickly used up. Some of them say the Center-South Region is suffering a crisis of consumption because of problems created by "a probable slowdown of the economy." However, these same technicians show, for example, that growth in some regions of the Northeast and North continue in the area of the 10 percent rate previously forecast.

Even the most optimistic officials cannot manage to hide a great concern. The decline in the consumption of power in the Center-South Region is reaching serious proportions because on the average it reaches around 6 percent, while forecasts had seen an average increase of 10 percent.

The government should not restrict itself only to increasing rates to balance revenues, criticize those same sources. This could even create a social crisis in the long run, they say. It is perhaps for this reason that the Ministry of Mines and Energy is making a study so that, as happened in the decade of the 50's, the industries will have reduced rates during certain hours.

Although some officials criticize this measure, saying that this is not much more than a "mere palliative," other technicians say that these benefits could ease the problem, it being foreseen that the situation will return to normal in two or three years.

The two largest hydroelectric powerplants under construction in Brazil, those of Tucuruí and Itaipu, are up to date on their timetable, work proceeds at normal rates and there are no changes foreseen in the plans despite the many problems the

government is having with the increases in the prices of imported equipment, world inflation and, particularly, with the frequent increases in international interest rates.

And while outside of money the greatest concern of Itaipu is to know how the power produced is to be divided between Brazil and Paraguay, the situation of the Tucuruí hydroelectric plant is more serious still. With more than two-thirds of the work of its first phase finished, land clearing operations, the responsibility of the Capemi Company, have not reached one-tenth of those scheduled, placing even the ecological balance of the region in danger in case the trees are not felled in time.

As serious as this threat is the danger that once in operation the power generated by Tucuruí could become surplus because one of the justifications for building this plant was that of providing power to ALBRAS [Brazilian Aluminum Corporation, Inc] and ALUNORTE [Northern Aluminum Corporation, Inc] which should consume almost one-fourth of production. While the timetable of the Tucuruí Plant is being met, those of ALBRAS and ALUNORTE are well behind schedule.

Exhaustion

While the problem faced by Tucuruí is much more an exception than a rule, that of the exhaustion of resources has already resulted in three different lines of reasoning which fuel the arguments. The faction which supports nuclear energy foresees the end of water resources in Brazil by the year 2000. Another faction, which leans more toward the electrical sector, says that it will never happen before 2020, and the third, which has recently emerged in university circles, advocates the theory that Brazilian hydroelectric resources are considerably greater than those known now.

The advocates of this third type of reasoning argue that research done in recent years shows that as more information becomes available, the more the potential grows.

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POWER TRANSMISSION DIFFICULTIES PLAGUING PROJECTS

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[Text] The power transmission system of Itaipu, budgeted at \$3.5 billion, is one year behind schedule because of a lack of funds. That at least was what Licinio Seabra, president of FURNAS [Brazilian Powerplants], admitted last June. He even explained one of the objectives of the project scheduled for that month: the construction ahead of time of an alternating current line of 750 kilowatts between the substations of Tijuco Preto and Ivaipora, establishing a strong link between the South and Southeast systems this year.

Now the management of FURNAS has provided the following information: The work of installation of the Itaipu transmission lines is on schedule, with all work proceeding normally. The company also asserts that funds have not been lacking for the execution of the work. Moreover, the lines are being installed in the stretch Foz de Iguacu-Ivaipora-Itabera-Tijuco Preto, with alternating current of 750 Kw, and in the stretch from Foz de Iguacu to Sao Roque with 600 kw of direct current with a positive and negative pole in a distance of 830 kilometers.

If the substations of Tijuco Preto-Ivaipora were to have been ready in June, how is it that they are only now being installed, according to FURNAS management? The work is really behind despite the fact that FURNAS will not admit it. This is so much so that FURNAS is now making a review of the work being completed by the contractors. All this means the following: The Tijuco-Preto-Sao Paulo line will only go into operation in 1982, as was admitted by Licinio Seabra, the president of FURNAS, last June.

To make up the lag in the Itaipu power transmission projects, the two bipolar stations to be built in Brazil pursuant to the terms of the bids, must be imported in order for there to be assimilation of technology. It was decided that the first would have to be completely imported. The second would have only 40 percent imported components, with the other 60 percent being manufactured in Brazil.

There is a reason for the lag in the work: A lack of money. Paraguay, whose power system is on 50 hertz did not want to convert to the 60 hertz Brazil has, even after receiving a promise of complete financing by Brazil for that conversion. That raised the costs of transmission excessively, also forcing the two countries to opt for the installation of nine turbines planned for 60 hertz operation and nine for 50 hertz. The result was that Brazil had to build a mixed alternating and direct current transmission system. As a new concession to Paraguay, it was later decided that the first nine turbines should be of 50 hertz on the Paraguayan side.

Three companies qualified for providing the bipole units: Asea-Promon, General Electric-Induco and Aeg-Siemens-Brown Boveri. The bidding was won by Asea-Promon. One of the requirements of the bidding was that all the engineering part of the project had to be done by a national company; should have a 60-percent share of nationally-built components in the conventional and nonconventional equipment, and all the installation should be done by a national company.

The plan for the transfer of technology was revised because deadlines were too short and there was a shortage of funds. A direct current simulator for laboratory tests, which was to have been installed in CEPE--ELETROBRAS [Brazilian Electric Power Companies, Inc Research Center], could not be installed.

Generating 12,600 megawatts--more than a third of the 30,000 megawatts of electrical power available to the country--Itaipu is considered the largest transmission and service voltage system in commercial operation in the world, with direct and alternating current, which means it has 600 kilowatts and 750 kilowatts, respectively, and also the one with the highest transmitted power.

According to Lucien Albert Francfort, sales director of Asea Electrica Ltd., in addition to the size, the power transmission system of Itaipu differs from others. "Transmission of power from a powerplant to the consumption centers is always done with alternating current. Since Paraguay has different cyclage than Brazil and did not want to convert its power system to 60 hertz, Brazil will have to build a mixed system of five transmission lines: two for direct current, which will carry one-half of the power generated by Itaipu (6,300 megawatts) and another three for alternating current, carrying the remaining 6,300 megawatts."

Francfort admits that the fact that Brazil adopted the American cyclage system of 60 hertz instead of 50 hertz, which is more traditional in Europe and Latin American countries, will make it difficult to exchange electric power with the countries of the Southern Cone.

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COST OF ITAIPU TRIPLED IN SEVEN YEARS

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[Text] The constant increase in the price of petroleum, the increasingly high rates of interest on the domestic and foreign markets, and world inflation, increased the prices of materials more and more and as a result increased the costs of servicing the debt of the Itaipu project.

When one talks of Itaipu, one thinks of millions of dollars, extremely high costs, dazzling operations, a gigantic project in which is placed the hope of the government of decreasing the electric power deficit of the country. In 1974 the initial forecast costs were \$6.5 billion, but the budget of the Itaipu Hydroelectric Plant has been undergoing frequent readjustments. For that reason, the final cost of the project will have tripled in 1988. According to the most moderate estimates, \$15 billion will be spent on the dam and powerhouse project and another \$3.5 billion for the alternating and direct current power transmission system, for a total of \$18.5 billion.

ELETROBRAS and FURNAS are in serious financial difficulties because of the construction of Itaipu and other expenditures such as those of the nuclear sector and other hydroelectric plants. If they were private companies, they would have gone into bankruptcy long ago. When the Itaipu hydroelectric plant is completed, it will be generating 12,600 megawatts at a cost to the consumer of \$1,400 per kilowatt. The plant is going to produce 75 billion kilowatt hours per year, of which 38.5 billion will be the Brazilian share and the rest Paraguayan, which could be purchased by Brazil at prices still to be determined through bilateral negotiations.

In this and next year, the effort to speed up the project will be enormous. According to General Costa Cavalcanti, president of Itaipu Binational, up to May of 1981 direct expenditures in the project were made in the amount of \$3,897,000,000. Considering that according to project cost estimates at January 1981 prices, total direct expenditures are at around \$8,010,000,000, it can be seen that another \$4,113,000,000 should be spent on the project, without taking into account the financing charges, estimated by Costa Cavalcanti at another \$4 billion, which would result in a total cost of \$12 billion at the conclusion of the project in 1988. However, this estimate is considered to be very optimistic.

Moacyr Teixeira, administrative director of Itaipu Binational, says that direct investments this year are budgeted at \$1,250,600,000. Counting more than \$592.6 million in interest and accounts to be paid, in addition to the need for \$200 million in additional expenditures, costs in 1981 will not be below at least \$2 billion.

The thing that destroyed the initial cost estimates was the dollar. A cruzeiro devaluation with respect to the dollar of only 70 percent was foreseen, but this did not happen. Moreover, the prices of equipment and materials bought in Brazil are undergoing readjustments, which are much greater than expected. Costa Cavalcanti says that because of questions of a technical nature required by the project itself, it was necessary to increase the percentage of iron and cement per cubic meter in the power house, in addition to increasing the dirt fill of the lateral dam walls.

This means that Itaipu needed another \$200 million since July. The project by itself represents 10 percent of the overall expenditures of the government, explains Moacyr Teixeira. In 1982 the expenditures in Itaipu will be greater still and should reach \$1,450,000,000. After that they will begin to diminish until they reach \$200 million in 1988, when the turbines will be installed.

The Itaipu Binational management guarantees: "We are neither ahead nor behind schedule, we are right on time," in the execution of the project. There is no lack of money either. The next necessary step is the filling of the reservoir, which will take place between September and November of next year. However, this date could be changed for several reasons, among them the amount of water available.

Itaipu Binational also provides this information: By the end of this year, the 300-ton wheel built by the national firm Voith-Vibase for the first of the 18 turbines of the hydroelectric plant, will be delivered. After that delivery, the rest will be delivered every four months. The following component parts of the turbine are being built: lining of the inlet, the predistributor and the spiral housing, which has already been subjected successfully to pressure tests, and the lining of the turbine well. In a more advanced phase will come the concrete pouring of the second stage, which involves all those components.

Next month, the distributor of that first Itaipu unit will be taken from Sao Paulo to the project site in Foz de Iguacu. The critical point of the execution of the undertaking resides in the installation of the equipment. The civil engineering work has been practically concluded. Within the space of 30 months, three important goals should be attained: damming of the Paraguay River by November of 1982; placing of three generating units in operation in 1983 and the installation of the transmission lines under the responsibility of FURNAS.

Itaipu, however, still has many problems in the political and diplomatic area as it has had since 1966 when the project was first conceived. They are problems which involve interests of two countries: Brazil and Paraguay. However, the main effects of that project may eliminate some conflicts in the Southern Cone, bringing together the energy interests of Brazil, Paraguay, Uruguay and Argentina.

Will the government build another plant similar to Itaipu, involving the interests of two countries? According to Brazilian technicians, it will not. A similar project, which would use the hydroelectric potential of the Uruguay River, for example, would not be built. A case in point: the joint commission studying the hydroelectric potentials of Gabari and Roncador has already decided that each country shall be responsible for its share of investments and that each one will have its own powerhouse.

The experience of Itaipu was not one of the happiest for Brazil, in the opinion of the binational company technicians. The different stages of development between Brazil and Paraguay forced Brazil to assume the burdens of that project by itself. Paraguay, with a GNP of \$1.5 billion was in no position to ask for loans abroad. That is why that Brazil had to assume the loans and payments. Negotiations begin in 1982 for the first sale and purchase contract for the power produced by Itaipu. The second term of General Costa Cavalcanti as director general of the binational company ends in 1983. It is said that Paraguayan Enzo Debernardi, the present codirector, would like to replace Costa Cavalcanti. To him this post would practically mean being the successor to President Stroessner in Paraguay.

It will not be until 2022 that Paraguay will use all its share of the power generated by Itaipu. With an overall production of electric power of 130 billion kilowatt hours per year in 1988, it will be important for Brazil to buy the greater part of the 38.5 billion kilowatt hours per year that are the Paraguayan share, however, that depends on the price per kilowatt. Although Costa Cavalcanti declares that Paraguay will always sell its power to Brazil at cost, since it will not be able to use it on its own market and the treaty between the two countries established parameters to determine the costs of power, there is always a good margin for negotiation of prices.

The Itaipu Treaty establishes the standard for determining the prices of energy to be provided to ELETROBRAS and ANDE [National Electric Power Administration] of Paraguay as cost "because the concern about profits is excluded," says Costa Cavalcanti. Only the amount needed by the company for paying the commitments assumed during construction and for the maintenance of services will be charged.

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DETAILS OF TUCURUI POWERPLANT CONSTRUCTION EXPLAINED

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[Text] When the first phase of the Tucurui Hydroelectric Plant is operating at maximum power, producing four million kilowatts, Brazil will have spent no less than \$3 billion. That is if the spending estimates are correct this time, because the first studies made while the Geisel Administration was still in power and its construction initiated in 1975, are quite far from reality.

Actually the error was very great because initial estimates forecast expenditures on the order of \$1.4 billion. This enormous difference was quickly justified and the responsibility for the additional \$1.6 billion was attributed to the new requirements for insurance at the work sites, constant increases in costs of imported equipment and international inflation (rising interest rates).

The Tucurui Hydroelectric Plant was conceived with two phases: one for four million kilowatts, with the first unit going into operation approximately two years from now (330,000 KW), and the others every three months, in addition to another two turbines of 25,000 KW. The second phase will not be finished until 1995.

How It Will Be

The Tocantins River, where the hydroelectric plant is located, crosses the central highland of Goias in the direction of Belem, and runs for 2,100 kilometers. With many rapids and currents, 550 kilometers of the river could become navigable from Belem to Maraba with the completion of two locks, each of them with 35 meters of water level, alongside the Tucurui Dam. This system is going to allow the transportation of 220 million tons per year in 4,000-ton flatboats forming convoys of up to eight vessels.

To have an idea of the size of the Tucurui Dam, it is enough to take a look at the Rio-Niteroi Bridge. There are 13 kilometers of dam to control the power of the Tocantins River. Its spillway will be the largest in the world, with a flow of 110,000 cubic meters per second. Another comparison can be made here: Itaipu, for example, has a flow of 43,000 cubic meters per second.

The figures for the Tucurui plant also win over those of the Itaipu Plant in the volume of water impounded. There are 43 billion cubic meters compared to 29 billion, almost 50 percent more.

For the Tucuruí Powerplant to become a reality in the middle of the jungle, it was necessary to build a floating concrete dock on the bed of the Tocantins with a capacity for handling 42,000 tons of cargo per month. All construction material arrives by flatboats from Belém.

The difficulty posed by the lack of more rapid transportation has not become a problem up to now as serious as the flood of March this year, which was responsible for the abandonment of the philosophy of economy in the project. That month the Tocantins River reached a flow of 68,000 meters per second. This figure, according to computers, could only happen with an eight-percent probability, which means eight times every 100 years.

Based on a local popular saying: "In the Amazon Region the impossible always happens," ELETRONORTE sought to change the policy of economy. The money allocated for the construction of the cofferdam, for example, was replaced by a more realistic amount and more money was injected.

Of the 12 330,000 KW turbines, ELETRONORTE has already guaranteed eight and is negotiating for the other four. To safeguard the spillway and the two powerhouses, which will have an area of three kilometers, it was necessary to build eight kilometers of dam on land on the right bank and another two kilometers on the left bank.

Criticisms

Technicians of the Amazon Region National Research Institute (INPA) are issuing veiled warnings about a danger: the prospect of the largest tropical forest in Pará becoming the largest dead lake in the world within two years. The reason for this is that the Tucuruí Project already has about two-thirds of its work concluded and up to this time CAPEMI, the company which won the bid to clear the region, has not yet managed to fell even one percent of the trees in the area to be flooded.

This forest must be removed from the area under any circumstances, say some of the technicians, because in a study made by a commission of interministerial technicians from the Ministries of Agriculture and Mines and Energy it was concluded that if the great mass of vegetation were to be submerged, it would begin to decompose and in the process consume the oxygen in the water. This would result in the putrefaction of the water and the subsequent death of fish and vegetation.

In addition to that damage, the water laden with carbonic gas would initiate the creation of hydrochloric acid when it strikes the turbines of the plant, acid which would impregnate the entire environment. A similar phenomenon, but of much smaller proportions, took place two years ago in Curua-Una, a hydroelectric station located near Santarém. There the operators of the plant could not even remain in the powerhouse without running the risk of being poisoned by the gases.

But even if that did not happen, and CAPEMI managed to remove the timber from the area to be flooded, the Tucuruí Project will continue to have enemies for having flooded 216,000 hectares of forest, which contains two cities, one railroad (abandoned), 21 diamond claims, one gold and one limestone deposit, 9 million cubic meters of hardwood, part of an Indian reserve, and even 80 kilometers of the Trans-Amazon Highway, inaugurated just a few years ago.

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JAPANESE BLAMED FOR LAG IN COMPLETION OF KEY PROJECTS

Sao Paulo O ESTADO DE SAO PAULO in Portuguese 13 Nov 81 Special Energy Supplement
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[Text] "We have to break the vicious cycle whereby no industries are installed in the Amazon Region because of a lack of power and no hydroelectric plants are installed because of a lack of consumption."

With these words, but with the promise to make the industrial projects of ALBRAS and ALUNORTE viable, Minister Sigiaki Ueki justified the construction of the Tucuruí Hydroelectric Plant during the Geisel Administration. Ueki did not forget to mention the railway project, that is going to link the Carajas Mineral Complex to the port of Itaquí, and the Aloca aluminum plant in São Luiz, Maranhão.

Spending double the amount of money foreseen, the Tucuruí has already completed more than two-thirds of its work. However, how are the projects of the industries for which the plant was built progressing?

The work of the ALBRAS and ALUNORTE factories is behind schedule and the power generated in Tucuruí could be surplus and have to be transferred to the Northeast, while the hydroelectric plants of Sobradinho and Paulo Afonso should be sending part of their production to the Center-South.

This situation could become even more serious with the entry into the picture of the power generated at Itaipu. It is feared that there will be a surplus in all the power systems of ELETROBRAS, particularly now that consumption of electricity has been declining because of the recession and the continuous rise in rates.

Brazilian technicians blame the Japanese for the lag in the ALBRAS and ALUNORTE projects (the Vale do Rio Doce Company has 51 percent of ALBRAS and 60.2 percent of ALUNORTE, with the remaining share being held by Nalco-Nippon Aluminum and Amazon Company, a consortium of 32 Japanese companies and banks). The charge, made in a confidential manner, says that Japan is waiting for the Brazilian balance of payments to deteriorate even more so as to be able to negotiate under better conditions for the share division of the two projects.

Japanese technicians, however, deny that desire for greater advantages by their country. They reply, saying that the Brazilians scurry about a lot and do the same thing several times, while they take a long time in planning, study the

projects well and are fast when it comes to execution. That is why, they say, their reports run to the year 2004.

While the Japanese technicians are studying the costs of transporting bauxite, which will be moved on the Trombetas River 800 kilometers to Barbarema (also using the Amazon River), the earth-moving work for the installation of an industrial complex in a place known as Vila do Conde has been completed. Caustic soda, sulphuric acid and petroleum coke plants will be built there.

ALUNORTE comprises the construction of a high quality aluminum oxide plant with a capacity of 800,000 tons per year, with the possibility of having its production doubled in a second phase. This plant, which is located in the Barbarema Municipality, as does Vila do Conde, and is called Ponta Grossa, is going to use the Bayer production process to allow the product to be sold abroad.

According to the latest forecasts, ALUNORTE will begin to produce alumina in August 1984 at an estimated rate of 80,000 tons. However, the following year it should be producing 800,000 tons, when the plant reaches its full capacity in that phase. All the alumina produced in Ponta Grossa will be primarily destined for the aluminum plants in which the Vale do Rio Doce Company participates. Since the ALBRAS Project does not foresee its full capacity operation until 1989, ALUNORTE should provide part of its production to other national consumers in the period between 1984 and 1988, replacing imports estimated as costing \$418 million and even exporting the foreseen surplus, obtaining foreign credits of around \$138 million.

These two plans are going to directly provide nearly 8,500 jobs in 1984, still according to calculations. For this reason, a plan for the construction of a city of 70,000 inhabitants was given to Sao Paulo architect Joaquim Gomes Guedes. Its first phase already stipulates the asphaltting of 20 kilometers of streets next year.

Also for accomplishing the ALBRAS and ALUNORTE Projects, PORTOBRAS [Brazilian Ports Company] is building a river port at Ponta Grossa for the docking of ships of up to 65,000 tons. This will make of the city of Maraba a very important metallurgical center because all production must pass through it after the Tucuruí locks are in operation.

Of the four million kilowatts produced by Tucuruí, 23 percent will be consumed by the ALBRAS-ALUNORTE Complex, that is, 960,000 KW. The city of Belem will consume another 500,000; the Carajas Project, another 330,000 (including for the electrification of the railway) and the Alcoa aluminum plant will consume another 500,000 KW, making a total of 2,290,000 kilowatts.

The remainder of the four million kilowatts generated will be sent to the Hydroelectric Company of Sao Francisco--CHESF--which will give a greater reliability to the system and will result in the integration of markets, according to the chief engineer of the Tucuruí Project, Humberto Rodrigues Gama.

The Tucuruí transmission lines measure 747 kilometers, joining in Imperatriz, Maranhao, with the CHESF system going south. To the north, toward the city of Belem, it will have substations in Vila do Conde, Guama and Utinga. Of the 747 kilometers, 660 will carry 500 kilowatts and 87 kilometers will carry 230 kilowatts.

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URANIUM RESERVES CONSIDERED SUFFICIENT FOR NEEDS

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[Text] Present Brazilian uranium reserves are now sufficient for fueling 38 nuclear reactors (of the Angra II type of 1,245 megawatts) working with a load factor of 60 percent, for 30 years, according to estimates by NUCLEBRAS [Brazilian Nuclear Corporations] technicians. The distribution of national uranium reserves (today estimated at 236,000 tons) is as follows: 140,500 tons measured, 95,800 tons

If the equivalency in tons of petroleum measure is applied, the 236,300 tons of uranium would represent 2,351,000,000,000 tons of petroleum. This is the equivalent of 14.8 times Brazilian petroleum reserves or 6.5 times the national reserves of coal.

Of the total of Brazilian uranium reserves, 56,600 tons are in the deposits of Pocos de Caldas (Minas Gerais); 8,000 at that of Figueira (Parana); 15,000 at the Iron-bearing quadrilateral (Minas Gerais); 5,000 at Amorinopolis (Goiias); 122,500 at Itatiaia (Ceara), 48,000 at the Lagoa Real (Bahia) reserve and 10,000 at that of Espinharas (Paraiba). In 1974 national reserves were estimated at only 11,040 tons of uranium. Of the deposits mentioned, only that of Espinharas is in the area allocated to NUCLAM--NUCLEBRAS Mining Assistance, Inc.--in which German capital has a minority share. By law, NUCLAM can only prospect in the areas allocated to it by NUCLEBRAS. Of the reserves it may find, 20 percent may be exported to Germany.

In the World

The largest uranium reserves which can be exploited economically are located by order in the following countries: United States, South Africa, Australia, Canada, Brazil and Nigeria. According to the IAEA, world uranium reserves (with an extraction cost of less than \$80 per kilo) are estimated at 3,160,000 tons. World reserves with a cost of between \$90 and \$160 per kilo are 540,000 reasonably sure tons and 590,000 additional tons are estimated.

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FIRST NATIONAL URANIUM ENRICHMENT PLANT TO RISE IN RESENDE

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[Text] NUCLEBRAS selected the region of Nhangapi in Resende, State of Rio, for the installation of its first complex devoted to the nuclear fuel cycle. Fuel elements will be converted, enriched and manufactured there. The selection of the site is justified by its nearness to the Pocos de Caldas uranium mine, the first to produce uranium concentrate in the country, by its easy access to the Angra dos Reis nuclear powerplants and because of the availability of power and social-urban infrastructure. The complex will consist of the enrichment plant and the fuel plant.

The conversion plant will be installed and operated by NUCLEBRAS itself and its purpose is the transformation of the concentrated ore produced at the beneficiating plants near the mines into uranium hexafluoride. The plant will have a production capacity of 500 tons of uranium hexafluoride per year and will begin operations in 1984, when it will be processing the concentrate produced in Pocos de Caldas, Minas Gerais.

The enrichment plant will be built and operated by NUCLEI [NUCLEBRAS Isotope Enrichment, Inc] and will use the centrifugal process to concentrate the assay level of uranium to a level of three percent of fissionable isotopes (U235). The ore is found with a level of 99.3 percent of isotopes 238 (nonfissionable) and only .7 percent of isotopes 235. That is the reason for enrichment, concentrating the fissionable isotope capable of fueling the heavy water reactors.

Construction of the Resende complex is planned to have three phases: in the initial phase in 1983, the first unit, called First Cascade, will be installed. In the next phase, with completion scheduled for 1986, the first extension of the first cascade will go into operation. Actual production of the demonstration plant will then begin. The plant will be entirely completed in 1988 and its normal production will be at least enough to provide two reloadings per year for a reactor of the type used in Angra I.



Angra I will be the first powerplant to go into operation.

The fuel element plant is for the production of fuel for PWR reactors, fuel based on hexafluoride from enriched uranium, with a capacity of 100 tons per year. The basic plan for the plant was prepared by the German company KWU with the help of Brazilian engineers. The project was completed by the Brazilian firm Hidroservice and the civil work performed by the Rodrigues Lima and Andrade Gutierrez Companies. It is the most advanced unit, with the first stage going into operation in 1982, producing the first reloading for Angra I. It will be completely finished in 1984, in time to meet the timetable of the second and third reloading of the powerplant.

Operation of the Installations

Any industrial installation working with nuclear energy is subject to control and supervision, being forced to obey national safety standards and norms. The National Nuclear Energy Commission (CNEN), which oversees the operation of nuclear installations, requires the execution of an internal nuclear safety program and another external program for monitoring the environment. The two programs are monitored by the CNEN by means of periodic inspections. In the area of control of radioactive material, each nuclear installation will follow a system of nuclear accountability which will be inspected by the International Atomic Energy Agency. The checkup of material undergoing processing will be accomplished continuously with a precision which will run to tenths of milligrams and the transportation of radioactive material will be done only after authorization of the CNEN and the IAEA, pursuant to national and international standards.

The systems of safety and control are already being structured and will be submitted for the approval of the CNEN when each industrial unit is licensed.

Industrial Wastes

International regulations indicate that the acceptable limits of uranium in drinking is .42 milligram per liter. To reach that concentration in the Paraiba River (Funil Dam), it would be necessary to accept the hypothesis that the entire production of the Resende Industrial Complex had been thrown into the river all at once. However, even that would leave the Paraiba River within acceptable limits for uranium in the water used by the population of the Paraiba Basin, according to the authorities responsible for the nuclear program.

NUCLEP

NUCLEP--NUCLEBRAS Heavy Equipment, Inc--is the factory of the NUCLEBRAS group responsible for the planning, development, manufacturing and selling of the heavy components of the nuclear powerplants. It is the first factory in the Third World capable of building nuclear reactors. It is located in the municipality of Itaguaí, along Highway BR-101, nearly 80 kilometers from Rio de Janeiro. Its present goal is to build heavy component assemblies for the so-called primary circuits of the nuclear powerplants: reactor pressure vessels, steam generators, pressurizers, accumulators and core structures. NUCLEP will also build storage structures for fuel elements and the turbogenerators and pumps for the primary circuits of the powerplants. Another recently created company (at the end of last year) to make up the complex headed by NUCLEBRAS is NUCON--NUCLEBRAS Nuclear Powerplant Construction Company, Inc--which has the monopoly of projects and construction of the sector. FURNAS [Brazilian Powerplants] transferred the contracts and responsibilities for the construction of the Angra I and II projects to NUCON.

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SEVEN STATE COMPANIES MAKE UP NUCLEAR COMPLEX

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[Text] NUCLEBRAS has been in operation since December 1974 and was created by Law 6.189/74. As a company of joint capital, with a majority of Brazilian capital, the company is directly responsible to the minister of mines and energy and is the executing branch of the federal government monopoly in the nuclear area, including the fuel cycle, sale of nuclear materials and also--since October 1980--in the construction of nuclear-electric powerplants.

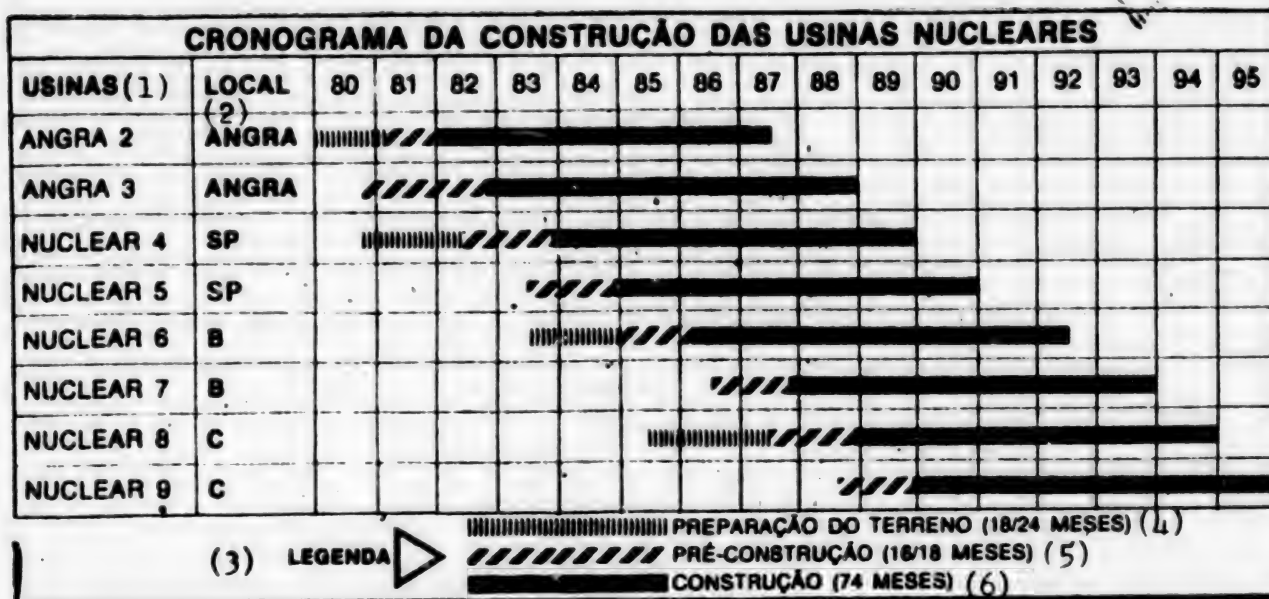
Pursuant to Brazilian law, the CNEN is the authority responsible for issuing licenses and setting standards. Electric companies must be the owners, users and exploiters of the nuclear-electric powerplants built by NUCON, one of the subsidiaries of NUCLEBRAS, which operates as the holding company of the entire complex. It has its offices in Brasilia and its administration in Rio de Janeiro.

The structure of NUCLEBRAS includes superintendencies for the production and research of nuclear materials, fabrication and reprocessing of fuel elements, research and development, planning, financing, sales and administration. Other activities, which are the responsibility of the company, are delegated to its six subsidiaries, four of them partnered with German capital. They are:

NUCLEMON (NUCLEBRAS Monzanite and Associated Elements, Ltd] produces ilmenite, zirconium, rutile, rare earths and monzanite. As a byproduct of industrialization, it produces uranium and thorium (NUCLEBRAS share: 100 percent). It is the only subsidiary which is active outside the area of execution of the Brazil-FRG agreement.

NUCLEN (NUCLEBRAS Engineering, Inc) provides engineering services for the basic project, construction, installation and commissioning of nuclear-electric powerplants in Brazil (NUCLEBRAS, 75 percent of capital); KWU, 25 percent).

NUCLEI (NUCLEBRAS Isotope Enrichment, Inc will build and operate a uranium enrichment pilot plant in Brazil, using the "jet centrifuge" system. (NUCLEBRAS, 75 percent of capital; Steag, 15 percent and Interatom, 10 percent). NUCLEP (NUCLEBRAS Heavy Equipment, Inc) plans, develops, manufactures and sells heavy components for nuclear-electric powerplants and other projects for the generation of power. (NUCLEBRAS, 75 percent of capital; KWU, 8 1/3; Voest, 8 1/3 and GHH, 8 1/3).



Timetable for the construction of the nuclear powerplants

Key:

- | | |
|----------------|---------------------------------------|
| 1. Powerplants | 4. Preparation of land (18/24 months) |
| 2. Site | 5. Preconstruction (16/18 months) |
| 3. Legend | 6. Construction (74 months) |

NUCLAM (NUCLEBRAS Mining Assistance, Inc] prospects, researches, develops and works uranium deposits and processes the uranium up to the production of concentrates. NUCLAM performs nearly 10 percent of the total effort of prospecting and researching uranium in the country. The rest is done by NUCLEBRAS. NUCLAM is active in areas previously granted by NUCLEBRAS. (NUCLEBRAS, 51 percent of the capital, Uran G, 49 percent).

NUCON (NUCLEBRAS Nuclear Powerplant Construction, Inc] administers and manages the construction and installation of nuclear-electric powerplants and the supply of equipment for them. (NUCLEBRAS share is 100 percent).

NUSTEP is a company with headquarters in the FRG. Fifty percent of its capital belongs to NUCLEBRAS and 50 percent to the German firm Steag. It holds the patent to the uranium isotope enrichment process by "jet centrifuge." In addition to its right to sell the jet centrifuge process, NUSTEP is responsible for the execution of technological research and development programs related to it.

The official program of NUCLEBRAS and its subsidiaries stipulates the construction of eight nuclear-electric powerplants, which should be in operation by 1995: The Angra I and II plants of the Almirante Alvaro Alberto Nuclear Center, which should be in operation in 1987 and 1988; two units which should be built between Peruibe and Iguape on the southern coast of Sao Paulo and which have their beginning of

commercial operations scheduled for 1989 and 1990, and four other units, whose location has not yet been decided, which will begin to generate power between 1991 and 1995.

The construction of units for the production of the fuel used in the operation of the plants is also scheduled. They include the uranium concentrate production unit in Caldas, Minas Gerais; a conversion (UF_6) unit, which should begin to operate in 1984 in Resende, Rio de Janeiro State, and a demonstration isotopic enrichment plant. The first cascade is going to be operational in 1983 and its first extension in 1986.

Also to be built are a fuel element plant, whose operation is scheduled for 1982, and a pilot plant for the reprocessing of spent fuel, which should begin operations in 1986.

NUCLEBRAS will also monitor uranium prospecting and research to insure a level of production compatible with the needs of the country and with an eye to the exporting of beneficiated uranium. In addition to that, the company will maintain the CDTN [Nuclear Technology Development Center], with a view to the transfer of technology stipulated in the agreement signed with Germany and the need to create an independent process of technological development.

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OFFSHORE PETROLEUM PRODUCTION INCREASING RAPIDLY

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[Text] Brazil is moving firmly toward reducing its subordination to imported petroleum in a significant manner, thanks to the discovery of new producing areas and the expansion of those existing. Although the idea of the discovery of gigantic fields has been discarded, the small and medium size deposits will be enough to propel present production of 240,000 barrels daily to an average of 500,000 per day in 1985, a goal which not surprisingly has placed Minister of Mines and Energy Cesar Cals and technicians of PETROBRAS [Brazilian Petroleum Corporation] in antagonistic positions.

The figures of national petroleum production are as yet not very significant if they are compared with the volumes produced by exporting countries. However, they acquire another significance because Brazil has a difficult geology and a shortage of petroliferous resources, since the major part of its sedimentary basins are crossed by areas of very hard rock which make the successful accomplishment of seismic surveys and the subsequent accuracy of drilling pioneer wells difficult.

The Sea, a New Element

Accentuated by the economic recession of the country, the decline in consumption of fuels somewhat alleviated the subordination to foreign supplies of petroleum. However, it did not fail to demonstrate the need to intensify prospecting, whether directed by PETROBRAS or indirectly by companies operating under risk contracts. Because the economy will then be reactivated, according to government plans, a larger volume of byproducts will be needed to attend to the requirements of economic growth.

The trajectory of national petroleum production began to be changed with the discovery in 1968 of the Guaicema marine oilfield on the coast of Sergipe. From that time on, the ocean floor began to acquire an increasing importance in the rates of production, compensating for the inevitable decline of the oil deposits of the coastal area of Bahia and the improbability of new discoveries on the land basins.

It was not accidental that all this happened. In the degree that land basin responses to the exploration process were unsatisfactory, the geologists went on to the only existing option: the search of the continental shelf. That work began in areas of shallow water of up to 50 meters in depth quite close to the shore but advancing rapidly in the direction of more remote and deeper areas, until a depth of a little more than 300 meters was reached. With the advances of the deep water exploration technology and with the high costs compensated for by the high costs of imported oil, a new phase in the production of petroleum in the country was begun. The discovery of the Garoupa Field on the coast of the state of Rio de Janeiro at the end of 1974, meant the final consolidation of the new trajectory followed by Brazilian petroleum.

Today, of the total of 240,000 barrels extracted daily, practically half comes from submarine deposits off the coast of the states of Rio de Janeiro, Sergipe, Rio Grande do Norte, Alagoas, Bahia, Ceara and Espírito Santo. In 1982, with the entry of new wells in the Campos basin in operation, production will exceed that of the land fields, making that region the first in the country, displacing the coastal area of Bahia from the historic position it occupied since the beginning of the decade of the 40's.

Importance

The importance of petroleum on the continental shelf can be evaluated by the fact that 13 years after the beginning of exploration nearly 600 wells have been drilled there, allowing the determination of 20 producing fields. The person pointing out this fact is Engineer Mauricio Alvarenga, superintendent of the PETROBRAS Production Department, who said that reserves of 968 million barrels of petroleum, of which more than 80 percent are in the Campos Basin, have been discovered in the undersea deposits. This region alone today has reserves estimated at nearly 800 million barrels, for a national total of 15 billion barrels.

Even so, the search for new petroleum deposits on the land basins has not ceased completely. In addition to the coastal area of Bahia, where the work to expand the old producing areas continues, activities are now being concentrated on a greater scale in the Amazon Region, where at the middle of the decade there were 50 deposits found, which were later classified as being commercially impractical in the example of Nova Olinda. With the help of advanced technology, natural difficulties presented by extensive and thick layers of diabase, a factor which distorts the results of seismic surveys and leads the geologists to make frequent errors in evaluation, are being overcome there.

After Jurua

After the 1979 discovery of the Jurua gas field in the upper Amazon Region nearly 900 kilometers from the city of Manaus, hopes were rekindled with respect to the Amazon Region being a storehouse of hydrocarbons. This led PETROBRAS to intensify exploratory drilling in the region in 1981. The expansion of the fields of Espírito Santo, still on land, whose reserves went from 5,309,000 barrels in June 1980 to 22,832,000 barrels in that month this year, is underway with an exceptional increase of 330 percent. In the Parana Basin, a sedimentary area of more than 1 million square kilometers, there was a resurgence of prospecting,

however, the presence of basaltic rocks here also makes seismic soundings difficult, which will delay favorable results.

The 5-year PETROBRAS plan covering the 1981-1985 period for projecting the development of national petroleum production is based on a realistic viewpoint, a necessary aspect for the formulation of an economic planning for the country and for national strategy itself. The plan took as presuppositions the present status of reserves and their expansion in areas not yet sufficiently developed (such as the Campos Basin), which guarantees a production of 370,000 barrels daily in 1985. The discovery of new deposits, based on indications which are valid to the geologists, will provide an additional 130,000 barrels per day, allowing the goal of 500,000 barrels per day to be reached in 1985.

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REDUCTION IN GASOLINE CONSUMPTION IDLES REFINERIES

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[Text] From every barrel of petroleum which enters Brazilian refineries (158 liters), the following is produced: 18.4 percent gasoline, 29.9 percent diesel, 26.7 percent fuel oil, 7.2 percent liquid petroleum gas and 17.8 percent other byproducts such as kerosene, asphalt and naphthas. This proportion of processing of the various byproducts was very different 8 years ago when gasoline represented 28.5 percent, diesel 23.5 percent and fuel oil 30.9 percent of the total. In the following years gasoline had its production gradually reduced until in 1979 it reached 21.5 percent, while diesel rose to 27.6 percent and fuel oil fell to 28.3 percent.

The accelerated reduction in gasoline production by national refineries was the result of the significant decline in its consumption, particularly after 1975 when the government began the policy of continuous increases in its price and increased the proportion of the anhydrous alcohol mixture. Since consumption of the other byproducts did not decline in the same proportion, particularly fuel oil and diesel fuel, imports of petroleum remained high until they reached the peak of 1.2 million barrels per day.

To avoid the creation of large surpluses of gasoline, PETROBRAS [Brazilian Petroleum Corporation] began mixing it with diesel oil and the main result of that mixture was that diesel became as inflammable as gasoline, requiring special safety measures in the gasoline stations and an educational campaign on a nationwide level to warn the users.

Despite everything, the changes in processing a barrel of petroleum led national refineries to follow the changes in the nature of national consumption, today characterized by greater consumption of the so-called heavy byproducts such as diesel oil and fuel oil, and a reduced processing of light byproducts, of which gasoline is the most representative.

At this time PETROBRAS is buying the so-called heavy oils in larger quantities. These are the oils which upon being refined produce a larger proportion of diesel and fuel oils, the petroleum from Venezuela being an example. Venezuelan oil, in addition to being the most suited to our domestic consumption, also has the advantage of being lower priced than other lighter types of oil sold on the international market.

Idleness

Planned at the beginning of the decade of the 70's, when the trend in national consumption of fuels was on the rise, the most modern refineries of the country, Paulinia (Sao Paulo) and Vale do Paraiba in Sao Jose dos Campos, increased national processing capacity to nearly 1.4 million barrels daily.

If it were not for the policy of reduction, that would be the consumption today. However, because of that policy of using alternate sources such as alcohol, gas and coal, national consumption now varies between 1 million and 1.1 million barrels daily. This means an idle refinery capacity of 300,000 to 400,000 barrels per day.

However, this margin of idle capacity does not frighten PETROBRAS. The reason is that the company adopted the policy of exporting surpluses of byproducts produced in its refineries and, in addition, it acquires an amount of crude petroleum from producing countries in exchange for byproducts. At this time nearly 100,000 barrels of byproducts per day are traded by PETROBRAS on the foreign market, thereby reducing the underutilization of its refineries and maintaining a margin of 100,000 barrels to compensate for possible shutdowns of units when there is a need for maintenance and repair services.

In the present refining policy, according to PETROBRAS Industrial Director Armando Guedes Coelho, there also prevails the idea of deactivating certain units, such as the one at Manaus, in order to obtain greater effectiveness in the operation of more modern installations. PETROBRAS is working on the premise that it is better to produce refined products at a lower cost in the southern region of the country and transporting them to the northern and northeastern part than to keep an antiquated unit such as the refinery in Manaus in operation.

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PEAK PETROLEUM PRODUCTION TO BE REACHED IN 1985

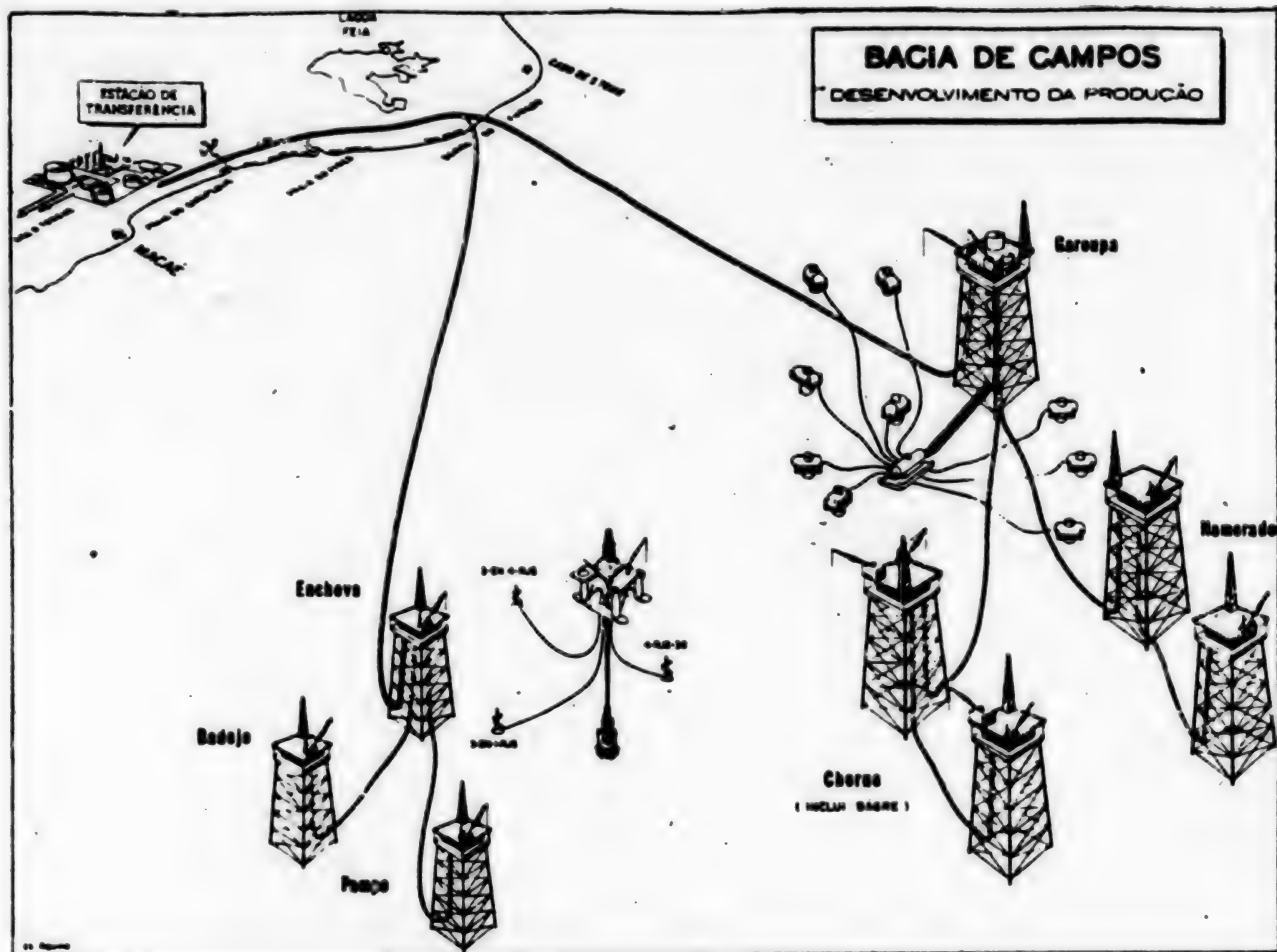
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[Text] The PETROBRAS 5-year plan envisioned an average production of 221,000 barrels per day this year. That average took into consideration the large share of the intermittent systems of the Campos Basin, which because of their own nature are subject to temporary stoppages, as has happened before, in the interests of safety. By 1982 that average should climb to 247,000 barrels per day, which is a conservative figure in view of the developments noted up to this month, capable of guaranteeing something around 280,000 barrels daily the end of the year.

In years to come, according to PETROBRAS, national petroleum production should increase substantially because the first completed systems now being installed in Campos Basin will have gone into production. In 1983 average daily production will increase to 335,000 barrels. The following year it will increase to 433,000 barrels and will reach 500,000 barrels daily in 1985.

As yet there are no estimates on the course of national consumption up to that date but surely dependence on petroleum will be considerably less than that of today due to the results of the alternate energy source programs (particularly alcohol and coal). According to the Ministry of Mines and Energy, dependence on foreign energy will be reduced in 1985 to exactly the same amount as the volume of national production for that year: 500,000 barrels per day.

All those estimates, according to PETROBRAS, do not include the probable results of the work being undertaken by companies working under risk contracts. The state company based itself on the premise that it can only make projections on the basis of its own knowledge of the petroleum potential of the country. Such a criterion, therefore, gives a very moderate aspect to its projections, particularly since with the acceleration of exploration in the risk contract areas, some finds should be made.



Development of production at Campos Basin

Key:

1. Transfer station
2. To Torgua
3. Includes Bagre

Spending is nto Everything

Petroleum deposits are not found in direct proportion to expenditures in the petroleum industry. On the contrary, they result from the joint application of well administered resources and the correct determination of objectives and the location of wells in places which favor the accumulation of petroleum. The discovery of petroleum, therefore, is not a question of spending money for drilling in an aimless manner, particularly because an oil well can cost up to \$10 million and not produce a single drop of oil.

For the exploration and production of petroleum and natural gas, the preliminary forecast of expenditures by PETROBRAS in the 5-year period 1981-1985 totals \$15 billion, a sum which is no less than 90 percent of the overall expenditures of the corporation in that period. The share of foreign money is restricted to

only 30 percent, since the greatest part of equipment orders will be made to national industry. Expenditures scheduled for 1981 are \$6,617,000,000.

That amount of money exceeds the sum of expenditures in the exploration and production of petroleum from 1968 to 1980, which totalled \$8.5 billion at average prices of the first half of this year. The PETROBRAS 5-year plan also foresees the drilling of no fewer than 1,781 wells by 1985, of which 806 will be on the continental shelf and 975 in the land sedimentary basins.

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ALCOHOL ALONE WILL NOT RESOLVE ENERGY PROBLEMS

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[Text] The National Alcohol Program [PROALCOOL] is an irreversible reality and a solution for the energy problem. However, it is not the only solution. Other alternate programs need to be developed at the same rate as PROALCOOL, at the same time that new technologies for the use of ethanol have to be created so that it can truly become a viable alternative.

That is the opinion of the majority of persons directly or indirectly linked to PROALCOOL: businessmen and new investors in the program, distillery project companies and producers of equipment for the alcohol industry and the automobile industry through the National Association of Automotive Vehicle Manufacturers.

"PROALCOOL needs to be viewed and placed within the context of other energy programs which complement it," says Jose Luis de Paulo Eduardo, director of PROQUIP, S.A. -- Industrial Engineering Projects. Francisco de Barros, director of BRASALCOOL--Brazilian Alcohol Company, Inc., says that despite the fact that PROALCOOL is a solution, there is the need to develop much technology of application also. "Alcohol chemistry is a reality which needs continuity. Anhydrous alcohol for adding to gasoline is also a reality, as is hydrated alcohol. However, alcohol can only become a fuel when its application to collective and freight transportation has been resolved."

PROALCOOL, created in 1975 and accelerated as of July 1975, is the first attempt by the Brazilian Government to develop an alternate energy source, according to Fernando Homem de Melo, professor of the University of Sao Paulo School of Economy and author, together with researcher Eduardo Gianetti Fonseca, of the book "Alcohol, Energy and Transports." At the same time, it is the only example of a program which has already has results and which has the conditions for making a reality of the goal established for 1985: the production of 10.7 liters of alcohol.

The objective of the program from the beginning was that of increasing agricultural production and industrial capacity, with a view to obtaining alcohol for replacing gasoline with a mixture at first and a greater use of alcohol in the chemical sector. Fernando Homem de Melo points out two phases in PROALCOOL. In the first phase, from 1975 to 1979 (resulting as an answer to the great rise in prices of petroleum in 1974), the goal was to reach a production of 3 billion

liters of alcohol in 1980. To have an idea of the effort ordered, alcohol production in the 1974/75 sugarcane harvest was 625 million liters.

The greatest part of the increase in alcohol industrial capability was provided through distilleries attached to the sugar factories. The professor adds that the first goal was reached due to the increased area planted in sugarcane, an increase of 29 percent in the 1976-80 period, and the increase in yield, which allowed the total production of sugarcane to increase in the same period by 43.7 percent. Moreover, says Fernando Homem de Melo, the increase in alcohol production was facilitated by the fact that there already existed experience with the sugar agroindustry and the alcohol industry in Brazil, there was an industrial sector devoted to the production of equipment and sugar exports were reduced, making it possible for the entire increase in production of sugarcane in the period 1976/79 to be made into alcohol. In addition, there were subsidized loans, which was the great instrument used by the government to encourage that production.

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ALCOHOL PROGRAM PREJUDICING FOOD PRODUCTION

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[Text] The expansion of the area planted in sugarcane in the country, replacing food crops, has been the most frequently emphasized danger by critics of the National Alcohol Program [PROALCOOL]. After all, in order to attain the goal of 10.7 billion liters of alcohol in 1985, it will be necessary to devote nearly another 2.4 million hectares to the growing of cane, doubling the area now planted with this crop, which now totals 2.6 million hectares. To reach the goal of 14 billion liters in 1987, it will be necessary to plant nearly 4 million new hectares, according to Fernando Homem de Melo, professor of the Sao Paulo University School of Economy.

In his book "PROALCOOL, Energy and Transports" written jointly with researcher of the Economic Research Institute Foundation, Eduardo Giannetti da Fonseca, which should be on sale next month, an entire chapter is devoted to the discussion of the distribution of land among various crops. The analysis is done on the basis of the three objectives established by the government for agriculture: production of food, production of renewable energy sources and an increase in exports. The researchers conclude that in order for the goals established for those three areas to be reached in 1985, the country will have to expand its cultivated area by 34 million hectares.

In the case of exports, Fernando Homem de Melo says that it was recently decided by the government that the priority goal to be reached in 1985 was \$24.3 billion in sales of agricultural products abroad (of a total of exports foreseen at around \$45 billion). This, according to him, is going to require an increase of 12 million hectares planted in export crops, which were those which showed the largest increase in planted area in the 70's.

In the area of food crops--prejudiced in the past decade by the increase in export crops--the university professors believe that it is necessary to obtain a growth rate in the production of those products at rates higher than the population increase rate to compensate for the differences in development which took place in the 70's. Thus, they reach the conclusion that by 1985 the area planted in those products should increase by nearly 12.2 million hectares.

Estimates for energy production made by Fernando Homem de Melo are based on the following government targets: production of 14 billion liters of alcohol in 1987; substitution for 16.2 percent of diesel oil by vegetable oils in 1985 and the plan for energy forests for the production of charcoal to replace fuel oil. The conclusion: It will be necessary to add another 10.2 million hectares.

Fernando Homem de Melo also says that PROALCOOL will contribute to the concentration of land in medium and large landholdings. Quoting the work of Agronomist S. Graziano da Silva "Agrarian Structure and Subsistence Production of Brazilian Agriculture," he shows that cane is a product which makes up the largest share of the production of medium and large landholdings. This means that 82 percent of sugarcane production is from holdings of more than 100 hectares. The rate for coffee is 41 percent, 34 percent for corn, 65 percent for rice, 51 percent for wheat and 28 percent for beans.

Based on PROALCOOL figures, he gives another example: "Up to December 1980 there was an increase in the capacity for the production of alcohol of 6.8 billion liters in 336 projects." That means an increase in the area planted in cane of almost 2.2 million hectares, or an average area of 6,400 hectares per distillery project.

In addition to a greater concentration of land, the expansion of areas planted in sugarcane, according to Fernando Homem de Melo, will not resolve the problems of a labor force in the rural areas; at the same time that employment in the growing of sugarcane increases, the level of employment in other crops will fall. He adds that work in sugarcane fields is seasonal, which should make the problem of migrant workers even more serious.

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NUMBER OF ALCOHOL DISTILLERIES INCREASING

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[Text] At the end of September there were 380 distillery projects registered in the National Alcohol Program (PROALCOOL), including in that total those units already in operation, in the installation phase or those about to be initiated. Altogether they represent a nominal alcohol production capacity of 7,851,000,000 liters per harvest. Before the institution of the program in 1975, there existed distilleries which today are responsible for a production of 903.6 million liters per harvest, according to information from the National Alcohol Executive Commission (CENAL). At the end of September there were also 84 projects being studied by CENAL, with a scheduled production capacity of 1,849,500 liters of alcohol per harvest. The projects for the creation of sugarcane nurseries envisioned by CENAL up to the end of September numbered 64 and should become future distillery projects with capacities estimated at 1,385,900,000 liters per harvest.

An analysis of the 380 projects approved up to the end of September by PROALCOOL indicates that the great concentration is in the center-south region, with 259 projects with a nominal production capacity of 5,364,100,000 liters per harvest, the greatest concentration being in Sao Paulo with 149 projects and a production capacity of 3,003,500,000 liters. In the north and northeast there are 121 projects which total a productive capacity of 2,486,900,000 liters of alcohol per harvest year. Of the 380 projects, 175 are for distilleries as adjuncts to sugar factories, with nominal production capacities of 3,122,100,000 liters per harvest and 205 projects are for independent distilleries with a production capacity of 4,728,900,000 liters of alcohol per harvest.

The production of 10.7 billion liters of alcohol, the goal set by the government, means expenditures on the order of \$5 billion, according to official estimates. The PROALCOOL budget has been established annually pursuant to the forecasts for disbursements for projects approved. This year, for example, an initial forecast for 44 billion cruzeiros for disbursements for industrial projects was increased to 84 billion cruzeiros. Overall, the PROALCOOL budget this year, including operating costs, reaches 115 billion cruzeiros.

The production goal of 10.7 billion liters of alcohol initially scheduled for 1985, will be "extended" to 1986 or 1987, according to the Ministry of Industry and Commerce, which is directly responsible for the management of PROALCOOL. Among other reasons for this are the economic difficulties of the country, which result in the small availability of financial resources.

Those difficulties are already noted in PROALCOOL. According to the government, the projects contracted in the financial agencies up to last 30 June will have disbursements guaranteed this year, however, the projects contracted subsequently will only begin to receive the first installments of financing as of 1982.

To analyze the financial availabilities for PROALCOOL, last June the government suspended approval and contracting of new projects and it was as a result of this analysis that it was decided that the projects contracted after July would only have their first installments of financings released the following year. That suspension apparently did not harm PROALCOOL because at least in terms of projects, counting those approved and under study, the production goal of 10.7 liters is practically guaranteed.

The Brazilian Government signed a financing contract for \$250 million for PROALCOOL with the World Bank. It could be only the first installment of a larger loan, since the bank shows a great interest in the program, which it considers "the most important" initiative in the world in the field of alternate energy sources.

The forecasts for alcohol consumption in coming years are being revised by CENAL because the sale of alcohol-fueled vehicles is reaching the levels authorized by the government. This year, for example, the automobile industries could have placed up to 360,000 alcohol-fueled vehicles on the market, however it is unlikely they will exceed 150,000 units.

The forecast of an annual consumption of alcohol by vehicles fueled exclusively by alcohol is based on the number of units in circulation on the previous year and multiplying it by 3,600 liters (estimated individual consumption) plus the number of vehicles which will go into circulation this year multiplied by 1,800 liters.

If consumption of hydrated alcohol by vehicles fueled by alcohol were to be less than expected because of fewer sales of those vehicles, the government could direct a larger part of production to anhydrous alcohol, which is mixed with gasoline, and increase the proportions of that mixture. Moreover, alcohol is also used in the alcohol chemistry industry. This year it will receive 500 million liters.

Alcohol Production in Brazil (in liters)

Harvest	<u>Hydrated Alcohol</u>	<u>Anhydrous Alcohol</u>	<u>Total</u>
1970/71	385,000,000	252,000,000	637,000,000
1971/72	223,000,000	390,000,000	613,000,000
1972/73	292,000,000	389,000,000	681,000,000
1973/74	360,000,000	306,000,000	666,000,000
1974/75	408,000,000	217,000,000	625,000,000
1975/76	322,000,000	229,000,000	551,000,000
1976/77	364,000,000	300,000,000	664,000,000
1977/78	293,000,000	1,717,000,000	1,470,000,000
1978/79	395,000,000	2,096,000,000	2,491,000,000
1979/80	671,000,000	2,712,000,000	3,383,000,000
1980/81*			4,071,000,000

Consumption

1978	1,430,200,000	-	1,430,200,000
1979	2,225,200,000		2,225,200,000
1980	2,259,000,000	389,000,000	2,648,000,000

*Forecast/Source: Brazilian Petroleum Corporation

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RISK CONTRACTS BRINGING NO RETURNS TO FOREIGN DRILLERS

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[Text] North American Geologist William Fischer, a Department of State consultant, forecast in 1975, after former President Ernesto Geisel announced the establishment of risk contracts, that it was unlikely that international petroleum companies would be successful in the exploration for petroleum in our country if they followed traditional methods. PETROBRAS [Brazilian Petroleum Corporation], he said, had already discovered the secrets of the continental shelf and the foreign companies would have to spend at least a certain amount of time to catch up with PETROBRAS.

Six years after the institution of risk contracts, the observations made by Fischer appear to be true. Foreign companies, in the first phase, and Brazilian companies in the second phase, have already drilled 50 wells on the continental shelf and the land basins without success. Nearly \$800 million were spent without any return since the beginning of 1977, when British Petroleum, one of the "Seven Sisters," began the risk contract phase by drilling a pioneer well in the Santos Basin, up to that time an area considered as having few possibilities for producing petroleum. From then up to now other sedimentary areas were equally searched in vain, areas such as the mouth of the Amazon, Barreirinhas Basin in Maranhao and a part of the Parana Basin on land.

The main reason expounded for the existence of risk contracts is the inability of the country to finance greater amounts of exploration. Foreign debt weighed heavily in making the choice to have foreign participation in the search for oil in the country. The contracts, therefore, emerged as the most economical and practical way for developing the necessary exploratory effort, together with PETROBRAS, for learning the true petroleum potential of the nation.

The results of that activity did not fail to pay dividends to the country. In the first place, high risk investments were avoided, investments which could certainly not be completely assumed by PETROBRAS because of its own physical and human resource limitations. In the second place, the amount of \$800 million spent by the companies, which are now working under risk contracts, would have had to be spent by PETROBRAS also. The work by foreign companies served for a comparison with the methods used by PETROBRAS itself and for a subsequent improvement in productivity.

Until their introduction in the country, risk contracts were unknown to the executives of PETROBRAS. Nothing was known either about how to observe the work of other similar companies, how their decision-making structures worked, and above all, what to do to make of the contracts an effective instrument for complementing, with outside technology and resources, the work accomplished by itself by PETROBRAS for more than 20 years.

Optimism Despite Everything

Lauro Viera, chief of the Superintendency for Exploration Contracts (SUPEX), remains optimistic, even when faced with the negative results obtained up to now by risk contracts. Viera was responsible for the structure of SUPEX, an agency created by PETROBRAS exclusively to watch over the execution and supervision of contracts.

For him it is still too early to evaluate the contracts because as yet only a small number of pioneer wells have been drilled when the enormous area of sedimentary basin is considered. Since the search for petroleum is a continuous process of actions and reactions and permanent interpretation of data, the rate of failure is natural, particularly when the peculiarities of Brazilian geology and the fact that the largest part of sedimentary basins on land consist of Paleozoic rocks, precisely those which throughout the world contain the least petroleum, are taken into account.

According to Lauro Viera, risk contracts had the advantage of showing new exploratory methods and concepts. As they search in areas not considered priority areas by PETROBRAS, the foreign companies broke certain barriers to prospecting of areas with a high exploratory risk. The contracts also allowed a better evaluation of the operational productivity of PETROBRAS, particularly in deep water.

Diminishing the Risk

The participation of only four foreign companies in the first auction of risk contracts aroused some doubts as to the value of those instruments in attracting the interests of companies experienced in the work of petroleum exploration and production. There arose criticisms against what was considered the inflexibility of the contracts, the many demands made by PETROBRAS and the high price of the participation fee, at that time \$400,000, to be paid for the information available on the block to be explored.

As the work by the foreign companies was unsuccessful, greater pressures were brought to bear for making changes in the contracts. The companies, naturally, needed to reduce risks and reduce costs, keeping in mind that they would be working with a great deal of uncertainty and also with a lack of knowledge about the Brazilian subsoil. Little by little the contracts then began to undergo small changes, maintaining, however, their basic structure. However, those modifications preserved the basic content of the policy of the contracts: It was a matter of offering only areas of exploratory risk, without allowing the companies to operate in already-producing areas such as the Campos Basin.

Three modifications were then authorized by PETROBRAS in order to attract a larger number of companies, particularly from abroad. The first was the reduction of the participation fee, which declined to \$250,000. The second was the permission to sign contracts with a drilling option. The contractor assumed the obligation of making seismic surveys but not necessarily the obligation of drilling if the results of the seismic survey made it inadvisable. In the original form of the contracts, the companies had a certain time period in which to drill. If the prospecting deadline passed and no drilling had been done, the area had to be returned to PETROBRAS. The operational mode of the contracts with the option to drill was primarily adapted to the land areas, where the risk is higher, as in the Amazon Region. The third modification in the contracts was the providing of information to the contractors on the entire geological basin where the block to be explored was located instead of information only on the block, as was stipulated in the first contracts.

As a result of those changes, the auctions following the second one became more competitive, with a larger number of participants. The signing of contracts was accelerated, allowing the signing of 102 instruments of that type up to now for the seeking of petroleum in all the areas of the continental shelf except the Campos Basin and the land basins.

At this time there are 13 wells being drilled under the risk contract system.

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OIL IMPORTS TO AFFECT BALANCE OF PAYMENTS LESS

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[Text] The weight of the expenditures for imported petroleum on the balance of payments will be lighter from now on, ceasing to be a permanent source of concern to the government. This situation is not difficult to see in view of the tendency of OPEC to set the price of petroleum at around \$34 per barrel and the problems faced by many countries, which like Nigeria had to drastically reduce their production because of a lesser demand by importers.

The overall cost of petroleum and its byproducts this year should reach nearly \$10.5 billion. Subtracting revenues from Brazilian exports of petroleum and byproducts, it is very probable that net costs to Brazil will not exceed \$9.5 billion, for a total of expenditures for imports which should rise to \$26 billion.

Even if petroleum imports continue to be a big share in the country's balance of payments, there is no doubt that in relative terms their influence will have to decrease and cease to be the justification for the increase in the rate of inflation and other ills afflicting the national economy. Fluctuations in prices will not be as frequent unless new tempestuous events greatly affect the life of the countries of the Middle East.

Petroleum Reserves

<u>Region</u>	<u>1,000 Barrels</u>	<u>Percentage</u>
Middle East	362,071,000	55.83
Western Hemisphere	102,289,237	15.77
Socialist Countries	86,300,600	13.31
Africa	55,148,375	8.50
West Europe	23,085,000	3.56
Asia (Pacific)	19,630,500	3.03
TOTAL	648,524,712	100.00

Source: Oil & Gas Journal

Thus, Brazil will continue to have an exceptional firepower represented by the concentration of imports in a single company and also by the fact that the company is a "holding" company for a number of others whose products serve as bargaining instrument to consolidate the Brazilian presence in the petroleum-producing countries. It is also unlikely that Brazil will cease to safeguard the basic lines of the sales policy followed in past years and which consists of giving preference in negotiations for the importing of petroleum to the state companies of the producing countries. Today the participation of international petroleum companies in providing Brazil with petroleum is practically zero, it being limited to a part of the petroleum delivered by Saudi Arabia through Aramco, a company created by one of the petroleum "giants" such as Esso and Shell.

Other Options

To reduce the influence of expenditures in foreign credits for importing petroleum even more, PETROBRAS has been using part of its idle refining capacity for the placing of byproducts in certain markets such as those of North Africa, which do not have enough processing capacity.

Exports of crude petroleum (exported under the system of exchange for other petroleum of different quality) and byproducts this year will yield Brazil nearly \$1.5 billion. The country is placing nearly 100,000 barrels per day in some countries of the western coast of Africa (such as the Ivory Coast and Nigeria) and in Latin American countries such as Uruguay and Colombia. It is true that the present conditions of the international market facilitate those exports and that they could change in the future against Brazilian petroleum byproducts. However, since these are countries making a great economic development effort and therefore lacking in petroleum byproducts, everything indicates that Brazil will continue to have good customers for national refined products.

Another alternative developed by Brazil was the importing of crude petroleum from producing countries such as Nigeria linking it to a supply of byproducts in exchange. By means of such linked operations, PETROBRAS obtains the necessary amounts of raw materials for attending to the national needs in fuels and it uses the available capacity of national refineries efficiently. This capacity is planned for the processing of nearly 1.4 million barrels per day and today there is an excess available capacity of around 300,000 barrels per day.

Petroleum for a Longer Time

Present world petroleum reserves have been estimated at around 649 billion barrels. At present levels of production of nearly 60 million barrels per day, there will be petroleum for another 30 years. According to Carlos Sant'Anna: "Since it is expected that considerable reserves will still be discovered in the world, and keeping in mind that world petroleum production will decline as other sources of energy are able to attend to demand, there should be petroleum well beyond 2010."

The picture of the distribution of petroleum reserves shows the irregular concentration of petroleum in the world. The Middle East, with a total of 362,071,000,000 barrels, has 55.8 percent of world reserves. In that area, Saudi Arabia has reserves of nearly 50 percent of that total, a total of 165 billion barrels.

A reading of that uneven distribution of petroleum shows how the importing countries will continue to depend on supplies from the Middle East without any short term alternative. It is for no other reason that Brazil is intensifying its diplomatic and trade relations with the countries of that region, using petroleum as a lever for an ever-increasing interrelationship.

The large amount of petroleum acquired by Brazil in the countries of the Middle East has contributed to increasing its imbalance in trade with the exporting countries.

From 1971 to 1980, negative balances have been accumulating every year, totaling \$7,043,000,000 in 1980 for an accumulated total of \$28.8 billion in that period. In 1980 Brazil imported 80.3 percent of the petroleum acquired abroad from the six countries which make up the Middle East: Iraq, Saudi Arabia, Kuwait, Iran, the United Arab Emirates and Qatar.

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PETROCHEMICAL INDUSTRY HAS INCREASED 20 TIMES SINCE 1970

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[Text] According to Paulo Cunha, president of the Brazilian Association of the Chemical and Byproducts Industry [ABIQUM], the petrochemical sector has a challenge for the coming years: To face the most serious problem of the Brazilian economy, the balance of payments, whether it be through the substitution for imports by building units which will manufacture the articles being imported, or through exports.

"The raw material for the petrochemical industry is 5 to 6 percent of the total amount of petroleum consumed in the country. On the other hand, Brazil today has an enormous surplus of gasoline because of the National Alcohol Program [PROALCOOL], which is used for the manufacture of petrochemical products, including those destined for the foreign market. Even so there is an excess of gasoline and the trend is that there will be greater surpluses as alcohol takes up a larger share of the market. If we did not have a petrochemical industry, we would continue to import finished products which would increase the imbalance in the balance of payments even more than the imports of petroleum for the petrochemical industry," declares Paulo Cunha.

This year, according to the president of the ABIQUIM, there is a special export program for the sector, which entails \$600 million in sales by the end of the year. In 1980 the chemical industry had total sales of \$15 billion. "As an industrial sector, it is the largest in Brazil in terms of sales."

Exports by the sector increased when the manufacturers became aware of the existence of a difference between installed capacity and the capacity for consumption of the domestic market. That was the reason for mobilization by the petrochemical industry so as to export and maintain the units operating at near capacity.

The petrochemical industry today operates at a rate of approximately 30 percent idleness with respect to consumption capacity and not production capacity. However, Paulo Cunha does not believe that the petrochemical complexes were made too large. "When the complexes were planned, and even when they began to operate (that of Sao Paulo in 1973 and that of Bahia in 1978), they operated at full capacity. Up to 1980 whatever was produced was consumed. However, after 1980, Brazil changed greatly and the recession affected the complex and the industry as a whole."

In the first half of 1981, the slowdown which took place in the economy, according to Paulo Cunha, has two explanations, "the reduction in consumption and the creation of inventories throughout the industrial line. Subsequently there was noted an adaptation by the industry to new patterns of consumption. Now there is a recovery for intermediate chemical fibers and for the industry linked to fluids--solvents and resins--while there is a decline in the soda and PCV industries and that which is linked to civil construction.

For Paulo Cunha, the petrochemical industry can be considered throughout the world as one of the newest segments and in Brazil, taking the supply of ethane as a basis, one of the main basic petrochemical products, it can be seen that it is 18 or 20 times larger than it was in the decade of the 70's. "Next year, however, will be marked by mergers and takeovers of companies and by revisions of goals set for this decade in the chemical and petrochemical sectors. It is believed that the new level of installed capacity needed for the 80's will be 20 percent lower than that programmed at the beginning of last year. The decline in demand, which by the end of the year should reach 12 percent with respect to that of 1980, means a decapitalization for the sector."

The difficulties undergone by the chemical industry at the beginning of this decade, in addition to leading the companies to gather into stronger and more productive groups, brought another lesson: "Planning and administration of the sector will have to be made more and more based on an overall analysis of western economy and its direct influence on Brazil."

Historical

Getulio Lamartine, executive secretary of the CDI [Industrial Development Council] says that the Brazilian petrochemical industry began in Cubatao near the PETROBRAS refinery Presidente Bernardes around the middle of the 50's with the decision to install a nitrogenous fertilizer plant. "To meet that objective, the refinery was planned so that it would use the thermal cracking process aimed at producing a larger volume of residual gases which would serve as a raw material for the petrochemical industry. This was the great initiative of the government in the field of petroleum refining, although there was a small government refinery in Mataripe, Bahia, at that time."

The National Petroleum Council [CNP], from its creation 29 April 1936 until the creation of PETROBRAS 3 October 1953, was responsible for the production and refining of petroleum on a large scale in the country. In 1957 the CNP for the first time defined the concept of the petrochemical industry in a normative fashion, indicating the division into the petroleum monopoly reserved for the state and the petrochemical industry destined for the private sector.

The petrochemical industry was actually created in that period but it was "only after 1964 that a series of government measures accelerated the process of growth of the Brazilian petrochemical industry."

Thus, in October 1965 there was the presentation and approval of the plan for Petroquímica Uniao, the result of the merger between national groups and Philips Petroleum, which came to be the first Brazilian petrochemical plant in Capuava,

Maua, Sao Paulo. The Sao Paulo Petrochemical Complex came to attempt to substitute for imported raw materials which were adversely affecting the balance of payments.

The Petrochemical Complex of the Northeast, however, had other objectives: to be closer to the centers of production, allow a decentralization with respect to the Sao Paulo Complex, favor a national and private control, and assimilate technology. Between 1970 and 1975 it achieved a rate of 40 to 60 percent national components in its production and a substantial accomplishment of detailed engineering services in the country.

The Southern Petrochemical Complex, which should begin operations in 1982, was planned in 1974 because of the growth of the Brazilian petrochemical industry, confirmed by the forecasts on markets made in that period, and the objective was domestic self-sufficiency in petrochemical products. "Everything would be running according to schedule if it were not for the industrial slowdown which took place in the first half of 1981," concluded Paulo Cunha.

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CONTROVERSY EXISTS ON VIABILITY OF SMALL DISTILLERIES

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[Text] The authorization by Decree-Law 85,694 of last February for the installation of microdistilleries in the country with a production of up to 5 million liters of alcohol per day for self-consumption or for the sale of the surplus by the CNP [National Petroleum Council], did not eliminate the arguments on the economic viability of the micro and minidistilleries. On one hand there are great opponents who point out the lack of competitiveness of small-scale production. On the other hand, the defenders, who seek to show with numbers the advantages of small installations for the investor in the program and for the government itself.

"The mini and microdistilleries are completely impractical. All that discussion about them is simple demagoguery because neither of them will ever profit," says Lamartine Navarro Junior, member of the special group of the National Energy Commission and vice president of the Alcidia Distillery, the first independent distillery installed in the country.

Less radical, Waldir Gianetti, president of ABDIB [Brazilian Association for the Development of Basic Industries] and director of Dedine, a company which produces equipment for sugar factories and distilleries, says that the mini and microdistilleries do not have the conditions for competing with the large installations, requiring, therefore, a special program separate from PROALCOOL [National Alcohol Program]. The lack of competitiveness, according to Waldir Gianetti, would result from the impossibility of obtaining the same rate of sugar extraction with small equipment as that obtained with the large mills (around 92 percent, although there is the case of the 97 percent achieved at the Sao Martinho Factory), which reduces the yield in liters of alcohol per ton of sugarcane, making the product more costly.

"PROALCOOL is only going to attain its objectives if it is based on the mini and microdistilleries; they are the only solution," says Joaquim de Barros Alcantara Filho, agronomist and president of the Brazilian Association of Creators, which planned and installed a microdistillery with a production capacity of 5,000 liters per day at the Ermida Farm in Jundai. In addition to being economically viable and even more advantageous, according to him, those installations change the present makeup of PROALCOOL which "concentrates profits because it alienates the small owners, only allowing access to large corporations."

This is also the opinion of Renato Pavan, director of Interalcool Industria e Comercio, a company which produces equipment for distilleries with a production capacity of 2,500 to 20,000 liters per day. "PROALCOOL will only become practical through either alcohol macrocomplexes or mini and microdistilleries." According to Pavan, in its first phase the program depended on the already-installed sugar factories and today 95 percent of the alcohol produced in the country comes from adjoining distilleries. However, there is no way to enlarge them. There are then, the independents, which because they are large entail very high costs for the businessman and the government.

He gives an example: A distillery with a production capacity of 120,000 liters per day (among the smaller of the large ones) today costs nearly 1.4 billion cruzeiros. "But by the time the plan goes to CENAL [National Alcohol Executive Commission], is approved and the first resources released, it will cost nearly 2.2 billion cruzeiros. Adding the interest rates of 55 percent per year, when the project is actually begun it will cost no less than 6 billion cruzeiros."

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SMALL ALCOHOL DISTILLERY PRODUCTION TOO COSTLY SAY CRITICS

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[Text] Joaquim de Barros Alcantara Filho arrived at estimates close to those of Interacool in the distillery he built at the Ermida Farm with a capacity of 5,000 liters per day or 750,000 liters per year (working 150 days, but another 500,000 liters could be produced by processing sorghum). "This means that even working the same number of days as a large distillery, the cost of investments by the microdistillery per liter is three times smaller."

However, the main criticism of the mini and microdistilleries is the cost of production of each liter of alcohol. "Really, if the cost of production were to be divided by the number of liters produced, the large distillery would show advantages. However, if the interest rate of 55 percent on financing is added, the advantage would be by far with the microdistillery," says Joaquim de Barros Alcantara Filho.

He made his calculations (with figures from the first half of the year), comparing the production costs of a 5,000-liter-per-day distillery with another producing 120,000 liters per day, both working 150 days per year; the yield of the first being 60 liters per ton of cane and the second 70 liters per ton. The cost of the microdistillery would be: 15.2 million cruzeiros for raw material; 1.7 million for labor and miscellaneous costs (fuel, maintenance, and so forth), 10 percent of the cost of the raw material or 1.52 million cruzeiros, for a total of 18.5 million cruzeiros. This sum, divided by the number of liters produced (750 million), would make the cost 24.69 cruzeiros per liter.

The cost for the 120,000-liter-per-day distillery would be: raw material 311.9 million cruzeiros, labor 6.48 million, miscellaneous expenses, 31.19 million, for a total of 349.5 million cruzeiros. Dividing this sum by the number of liters produced in 150 days (18 million liters), gives a cost per liter of 19.42 cruzeiros.

Technology

What the critics of the mini and microdistilleries say is that it is not possible to obtain that high yield of liters per ton of sugarcane due to the low rate of extraction. Joaquim de Barros Alcantara Filho replies that by using 3-roller units and a diffuser he obtained an extraction rate of 87 percent and a yield of 60 liters per ton of cane at the microdistillery of the Ermida Farm. He quotes

the report by the EMBRAPA [Brazilian Agriculture and Livestock Enterprise] technician who supervised the process: "The use of the mill and diffuser in the production of ethyl alcohol from sugarcane showed itself to be highly compensatory, significantly increasing the yield of ethyl alcohol per ton of raw material (above 60 liters per ton).

The technology used by Interacool also allows the extraction of 88 percent of cane sugar, according to a report from CETEC--Minas Gerais Technological Center Foundation--in a measuring operation at the Bom Despacho microdistillery in Minas, which was planned by Interacool. It consists first of all of the preparation of the raw material by means of a shredder--adopted from a model used in the Tongat Plant in South Africa--which opens up the cells of sorghum, sugarcane or manioc up to 93 percent (normally the preparation of raw material is done by a system of knives with about a 60-percent opening of the cells). From the shredder the raw material is taken to the sugar extraction process, which can be done in two pieces of equipment: a special mill with a pressure of 300 kilograms per square centimeter on the rollers, which can extract 88 percent of the sugar with only one 3-roller unit, or a diffusing press which consists of pressing the cane or sorghum at the same time that the bagasse is sprayed with water, extracting from it, according to Ranto Pavan, up to 97 percent of the sugar. The mill, according to him, is recommended when the bagasse is to be used as feed for animals.

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INCREASING USE TO BE MADE OF COAL, COAL BYPRODUCTS

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[Text] The only product which has a captive market at this time, say businessmen, is coal, discovered by accident in the country in the last century and which only receives attention in times of crisis, like during World War II when coal from the Santa Catarina mines was responsible for keeping the furnaces of the National Iron and Steel Company going, or now, when steam coal-treated as rubble for several decades because of a lack of consumption--presents itself as an indispensable alternate energy source.

Today steam coal, for which no need for importing is seen, is sold at the coal dumps of CAEEB (Brazilian Electric Enterprises Auxiliary Company). It is rated as having 70 percent of the energy value of fuel oil. Coal for the metal industry is already bought when it emerges from the mine and has fixed destinations: USIMINAS and COSIPA [Minas Gerais Iron and Steel Mills, Inc. and Sao Paulo Iron and Steel Company, respectively] for use as coking coal. The CSN [National Iron and Steel Company] obtains the entire production of that same type of coal from the state mines for its furnaces. The iron and steel mills, however, use only about 20 percent of national coal for the coke used in the metal industry and import the rest. The reason for this is that they are adapted to the foreign raw material and obtain a lower steel production from Brazilian coal, which has a high percentage of ash.

Santa Catarina is the only state with reserves of coking coal, which is mined from the Barro Branco deposits by 12 mines as a maximum, with a production capacity of 600,000 tons per year of unwashed coal. This means that those mines, if started today pursuant to the government's energy program, would be exhausted in 25 years, even with only a 20-percent share in the consumption of coking coal.

Since the iron and steel production target is also ambitious for the next 4 years --it aims to satisfy a demand for steel in ingots and sheets of more than 62 million tons--the new companies of the sector should consume reducers (reducing gases obtained from coal) in the example of Aços Piratini which consumes the coal from Rio Grande do Sul and not coke. The reducers (which do not represent even one percent of production) produce sponge iron and not pig iron like the mills with blast furnaces.

SIDERSUL [Southern Iron and Steel Company] is already being installed in Santa Catarina. It is a company which intends to use coal as a reducing agent for iron ore, with a scheduled production of 150,000 of seamless pipe by 1984. Moreover, other options for the use of coal in the iron and steel sector are under study, such as the injection of "fines" (considered the "filet mignon" of coal, now being made into coke near the mining areas) in the blast furnaces. The "fines" however, are the only byproduct of coal, which is undergoing a significant reduction in its market because of the crisis in the automotive sector, its main consumer.

The coking plants are operating at 50 percent capacity, some having already shut down and others preparing to give collective furloughs to their employees this year end. However, there are suggestions for coping with the problem. Walcir Burigo, president of the National Association of Coke Producers, for example, talks of the possibility of reducing imports because "we are in a position to supply the market with the same quality coke as foreign coke." There would be, according to him, even the possibility of exporting "something which has not happened yet because we do not have competitive prices (nearly 45,000 cruzeiros per ton) due to our lack of a tradition in the sector."

Another coal byproduct which was never marketed, but which also depends on the installation of industries for its use, is the pyritic waste, which is highly polluting because of its high percentage of sulphur by comparison with the coal from Rio Grande do Sul. The pyritic concentrate obtained from waste and pre-processed in the producing region, releases sulphuric acid and sulphuric gas, polluting the air and water. This has become one of the greatest environmental concerns of the Environmental Secretariat, which considered the coal-producing region a critical area last year.

Use of this waste began recently in an initial test unprecedented the world by the Coal Chemistry Industry of Santa Catarina (ICC) located at Imbituva on the coast of Santa Catarina, which in two years consumed all the stockpile of the Capivari Coal Washing unit. With an estimated production of 300,000 tons of sulphuric acid per year, the company eliminates the imports of sulphur. The ICC has studied an expansion to 450,000 tons of sulphuric acid per year, of which 300,000 tons would be used for the production of 236,000 tons per year of phosphoric acid beginning next year.

The ICC, however, has caused another type of pollution, also without precedent, an acid rain on Imbituva, a city of something more than 15,000 inhabitants, whose residents are moving to surrounding areas far away enough to avoid the problem. Seeking to free itself of friction with the community, the ICC should spend \$10 million in the next 3 years for antipollution equipment, pursuant to an agreement with FATMA--Foundation for the Protection of Technology and the Environment.

8908

CSO: 3001/41

CONVERSION TO USE OF COAL DELAYED BY LACK OF MONEY

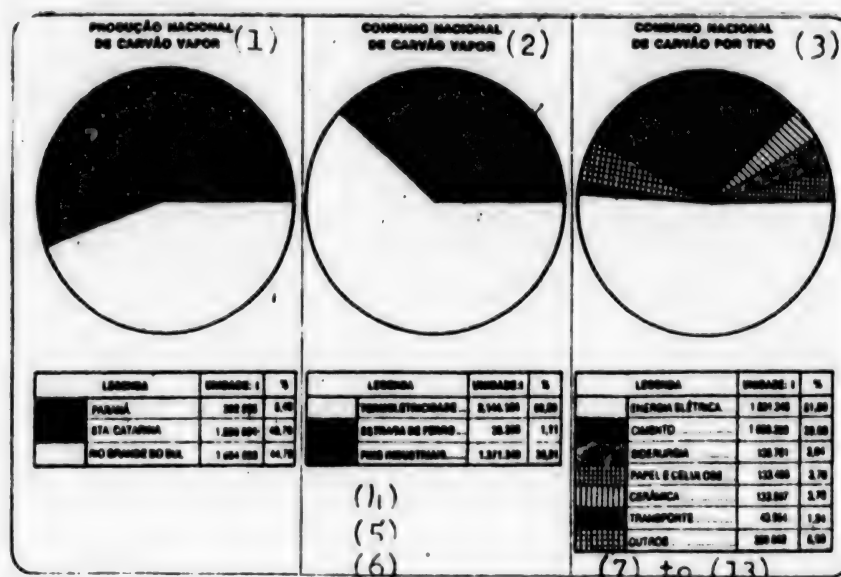
Sao Paulo O ESTADO DE SAO PAULO in Portuguese 13 Nov 81 Special Energy Supplement
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[Text] Today with a price resulting from the sum of the costs of production plus remuneration for the mines, depending on the percentage of ash, coal should cost the consumer no less than 4,500 cruzeiros per ton. The government, however, subsidizes that cost plus its transportation, allowing coal in theory to cost between 2,000 and 3,000 cruzeiros per ton.

Thermoelectric powerplants, however, remain the major consumers of steam coal with a share of 52 percent of the market, following by cement plants with 30 percent. The transportation sector (the Teresa Cristina Railroad) comes in last with a share of 1.3 percent. There is a forecast for the next 4 years of an increase in consumption by the iron and steel industry (from 2.8 percent it will go to 7.2 percent) and for the cement industry (3 percent). As a substitute for fuel oil, consumption of coal has been increasing in the industrial sector, which in 1969, for example, had only a .2 percent share in the coal market. That share rose to 10 percent in 1978 and a year later it reached 36.8 percent, providing a savings of \$9 million in petroleum.

Traditional consumers--thermoelectric powerplants, the Teresa Cristina Railroad and Aços Piratini (a direct reduction steelmill)--which in 1976 used 91 percent of the steam coal mined in the south, today use only 56 percent because the new consumers have taken a larger share of the market, going from 9 percent to 44 percent. A link in the chain, however, is making itself heard: "Today a larger number of companies could already be operating with steam coal. The problem is that they cannot convert their systems for burning fuel because of a lack of money," complains Waldir Dalcol, manager of the CAEEB [Brazilian Electric Enterprises Auxiliary Company] coal dump.

The Energy Mobilization Fund itself confirms the lack of money for financing the technical conversions of plants such as those of iron and steel, paper and cellulose, milling and cement. At this time it is studying the introduction of a mechanism into the gasoline pricing policy so as to make it possible to obtain resources for the coal consumption projects in those sectors. The Industrial Development Council of the Ministry of Industry and Commerce announces that it will require the use of coal instead of fuel oil before approving new industrial projects or new expansions.



Key:

1. National Steam coal production
2. National steam coal consumption
3. National coal consumption by type of industry
4. Thermoelectric plants
5. Railroads
6. Industrial purposes
7. Electric power
8. Cement
9. Iron and steel
10. Paper and cellulose
11. Ceramics
12. Transportation
13. Others

Businessman Fidelis Barato goes so far as to predict a collapse in the production of coal in the next 3 years if there continues to be a delay in the release of financing for the industries, which do not yet have a great deal of confidence in the supplying market.

The lack of money has already resulted in another frustration: The first coal gasification plant in the country, under the management of the Parana State Electric Company (COPEL), scheduled to go into operation within 3 years in Ponta Grossa, 100 kilometers from Curitiba, will not be installed. This plant, which would have allowed the substitution of 13 percent of the fuel oil consumed by the state, would have cost 3.2 billion cruzeiros in its first phase, with money coming from the Energy Mobilization Fund. To offset this, PETROBRAS [Brazilian Petroleum Corporation] signed a contract with the Rio Grande do Sul Government for 600 million cruzeiros to be used for a gasification plant project in Sao Jeronimo, the coal-producing region of Rio Grande do Sul. Its capacity will be 667 million cubic meters of gas per year.

Among so many projects for the expansion of the coal market, perhaps the most feasible would still be thermoelectric plants, today responsible for the consumption of two million tons of coal per year.

According to Minister of Mines and Energy Cesar Cals, by the year 2000 there will be 10 new units installed, two every two years, with a capacity for generating 300 megawatts [as published]. His ministry also foresees the conversion of the deisel-fueled plants within 5 years. They will consume 8 million tons of coal in the generation of electric power.

The Jorge Lacerda Powerplant in Tuburao--the largest in Latin America--by itself has a forecast consumption in 1986 of 6 million tons of coal, increasing its present generating capacity of 482,000 kw to 839,000. However, the final plan, to be concluded in 1988, stipulates the generation of almost 2 million kilowatts, becoming the largest thermoelectric plant in the world. Carlos Augusto de Moraes, an ELETROSUL [Southern Electric Powerplants] engineer in charge of the Jorge Lacerda Powerplant, advocates the expansion of thermoelectric production because he sees in it an infallible formula for maintaining power supplies.

"Even if its cost is nearly 30 percent higher than hydroelectricity (the kilowatt installed cost of the last unit of the Jorge Lacerda Powerplant installed last year was \$950) the thermoelectric powerplants should always represent 10 to 15 percent of electric generating capacity."

8908

CSO: 3001/41

SERIOUS PROBLEM POSED BY UNRELIABLE TRANSPORTATION OF COAL

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[Text] The delay in execution of the National Coal Plan should be attributed not only to failures in operations of the market but also to transportation: The simple explosion of a locomotive--an unprecedented event in the history of the Dona Teresa Cristina Railroad built in the last century--last August endangered the hauling of the Santa Catarina coal production, once more increasing the stockpiles at the mines.

The railroad, operating today only to haul coal, which it was hauling at a rate of 10,000 to 12,000 tons per day, after the accident reduced its capabilities to 8,000 tons. "As a precautionary measure, since the cause of the explosion of the locomotive is not yet known, the railroad began to work at a lower capacity, in addition to being 8 days without transportation," explains Col Jose Luis da Cunha Costa, chief of the office which represents the National Petroleum Council [CNP] in Santa Catarina, and coordinator of the group for coal-hauling operations.

The result was that the stockpiles of the Capivari coal washer, which were being hauled away with visible celerity, allowing the transportation of steam coal to be equal to that of coking coal for the first time in 30 years, increased and the operators saw their yards glutted with coal. The Prospera Coal Company, for example, last month had 70,000 tons of coal stockpiled at the mine entrance waiting for shipment. "We have a stockpile which in interest alone represents losses of 100 million cruzeiros, not counting the losses caused by rain," estimates Engineer Pedro Agricio Freitas of the Criciuma Coal Mine, revealing that of a quota of 60,000 tons per month, shipments did not exceed 40,000 tons.

"Everything will be restored this month," asserts Helio Mello, chief of the operations Division of the Dona Teresa Cristina Railroad (EFDTC), revealing that due to the accident, only two of the 13 Texas locomotives are operating. The railroad saw itself forced to borrow two diesel locomotives from Rio Grande do Sul. Of the 11 locomotives purchased from Argentina, three, whose boilers have been converted to use steam coal, will continue to operate to attend to demand. The rest are still being converted and five should be delivered to traffic by the end of the year.

Those problems are foreseeable, warned Helio Mello: "We do not have cars or locomotives on the shelves. There is a plan, prepared in 1975, for the electrification of the EFDTC, retiring the old locomotives. That electrification, estimated today to cost more than \$2 billion, despite the fact that it still depends on the attention that is intended to give to national coal, will really have to be accomplished."

Other projects also find themselves in the phase of being let out for bids. One of them is the 25-kilometer railroad link between Treviso and Lauro Muller, where large coal deposits were discovered. There are problems at the ports such as the one of Imbituva "We cannot even load 1,000 tons per hour but we have already initiated the installation of a conveyor belt with a 1,500-ton-per-hour capacity, an operation which will not begin until 1983," reports Bernardo Guimaraes, port traffic chief responsible for the shipment of 282,000 tons of coal to the states of the south and southeast.

The receiving port of Antonina in Parana is looking ahead to serious problems because of lack of money for expansion. "I cannot perform miracles," says Luiz Amatuzzi Pinho, administrator of the ports of Paranagua and Antonina. He provided this information: Of the 340 million cruzeiros requested from PORTOBRAS [Brazilian Port Enterprise] for 1982, 55 million were allocated. According to him, the forecast of 260,000 tons of coal for Antonina in 1982 has already been exceeded. "Today," says the administrator, "we receive 220,000 tons and the forecast for 1981 was 150,000 tons."

Antonina also has the problem of shallow water. There emerged a solution: the use of flatboats which would go to look for coal in Rio Grande do Sul, eliminating a number of loadings and transfers. Businessman Sebastiao Cavagnoli is ready to make a study of the feasibility of using flatboats in Rio Grande do Sul rivers as well as on the high seas. After all, the production of the Charqueada mines is moved by river flatboats, which average 400 tons each, to the railway at Porto Alegre.

"Greater consumption of coal depends on transportation. If the Southern Trunk railroad had the capability for transporting a larger amount than the present 30,000 tons we could satisfy the demand of Sao Paulo," says Ernesto Gurgel Valente, sales manager of CAEEB (Brazilian Electric Enterprises Auxiliary Company). However, to do that would require expenditures on the order of 10 billion cruzeiros, which means 10 million cruzeiros per kilometer, for the rehabilitation of the entire line.

In the South However, an Indiscreet Enthusiasm is Noted

"Black coal," "jigs," "washers," "bobcat," "dump cars," "pyrites," "coke," "endless belts," "draglines," "fines," "CPL," today, with the euphoria of coal, without the least idea of what those terms mean, one can hardly talk with the industrialists of the various cities of the southern part of the country. Coal or the complicated technology involved in its exploitation is in almost all conversations and in everything. Coal became the name of hotels and restaurants. Lottery houses, for example, carry suggestive names such as "Mine Road." The decision of the government to extract more and more coal from the southern deposits, caused the unsealing of old mines and the scraping of rust from abandoned machinery.

This is not so strange when it is known that coal, which had not been able to compete with petroleum at \$2 per barrel since World War II, attained a new significance with the energy crisis caused by the Arabs in October of 1973. Now, according to the report by WOCOL--World Coal Study--always quoted by businessmen and authorities, only coal can provide more than half of the energy the world needs in the next 20 years. The "coal race" began in Brazil last year when 40,094 soundings and 446 holes were drilled in the sedimentary basin of Parana alone. By 1985, according to the National Energy Program, soundings distributed throughout the states of Sao Paulo, Parana, Santa Catarina and Rio Grande do Sul should result in 713,500 meters of drillings.

The euphoria in the south can be explained precisely because this region has the most economically exploitable reserves. They are estimated at 22 billion tons, containing coal of several qualities. The reserves are distributed as follows: 73 percent in Rio Grande do Sul, 26 percent in Santa Catarina and the rest in Parana and Sao Paulo. This is a laughable amount when compared with world reserves, which total 11 trillion tons (of which 663 billion tons are of possible exploitation), however, they are enough to produce 22.5 billion tons in 1985, which is the equivalent of 170,000 barrels of petroleum per day, according to the goal established by the Ministry of Mines and Energy.

That coal-bearing region, however, will have the difficult task of making a total contribution of 27.5 billion tons of coal, enough to substitute for 210,000 barrels of petroleum per day. The revision of that goal, announced by Cesar Cals last year, to a production of 17 billion tons, lowering the substitution for fuel oil to 110,000 barrels per day, does not cease to be a challenge [Figures in preceding two paragraphs as published].

Even with the revised goal there is the need to expand some of the more than 30 mines being worked and to open new ones. Present production of nearly 5 billion tons, added to that forecast for the next 4 years, would be capable of substituting for 170,000 barrels of petroleum per day.

Up to now, accepting the challenged issued by the government, the 13 coal companies (all of them national) which operate in the country have already forwarded 28 proposals for undertaking mining operations, which total expenditures on the order of a little more than \$900 million, of which \$107 million is for imported equipment.

However, only 17 projects were analyzed and no money was released up to this time despite the stipulation that \$8 billion would be spent in the next 4 years on the National Coal Plan. Roberto Gabizio de Farias, president of the National Coal Mining Industry Union and owner of the Coplemi Mine in Rio Grande do Sul, had already warned the National Petroleum Council itself that in order for the goal to be attained it was necessary to allocate \$2 billion per year on the basis of 1978 dollars, including costs in the conversion and consumption of coal.

His estimates are based on the following equation: For a total production of 22.5 billion tons in 1985, it would cost \$53 per ton for mining, \$23 for transportation to the port, \$23 for loading and unloading at the port and another \$59 per ton on ships. "Investments would be compensatory because they would be repaid in 4 or 5 years."

At any rate, despite the delay of 1 year in the release of finances, the National Coal Plan of 1979 has already managed to bring a certain expectation to the businessmen who initiated the reactivation of some idled mines. However, no new mining area has gone into production because of the Plan, one of the reasons being that depending on its size, a mine takes nearly 4 years to go into operation. Therefore, as the mining entrepreneurs say, the increase in production will now depend on new mining endeavors.

Engineer Paulo Agricio Freitas, owner of the Criciuma Mine, believes it is unlikely that the Energy Mobilization Program will be complied with unless there is a quicker release of financing. "With all that bureaucracy," he complains, "We will not reach the goal. If we were to replace 100,000 barrels of petroleum per day it would be an extraordinary feat." His statement, corroborated by his colleagues in the sector, is based on the delay in the analysis of projects for new undertakings.

Minister Cesar Cals himself, when he recently inaugurated the Second Latin American Seminar on Bioenergy in Curitiba, speaking on the Brazilian Energy Model, could not say whether some money destined for the coal program had already been released for the new mining areas. The only coal company to receive financing, also a state company, was the Companhia Riograndense de Mineracao (CRM). The money is not from the energy program. As was explained by one of the directors of the main CAEEB office in Rio de Janeiro, Ernesto Gurgel Valente, the CRM obtained the approval for a foreign loan from the IDB.

The coal mines, meanwhile, are using their own resources to increase their production. "Our working capital, however, is disappearing," warns Fidelis Barato, owner of the Catarinense Coal Mine and sectional director of the National Coal Mining Industry Union in Santa Catarina, saying that the delay in freeing resources has already caused a lag of one year in the National Coal Plan, which was supposed to have begun 1973 at the beginning of the energy crisis.

Fidelis Barato explained that the coal mining sector, however, is going through its best phase at this time. Therefore, despite difficulties, the mine owners continue to bet on the program, justifying the euphoria in the south. Joao Zanette, for example, the owner of the Urussanga Coal Company (CCU) is installing laboratories for doing research on coal and has already reactivated two mines which have been inactive for almost 30 years. "All that," he reports, "with my own resources because I never asked for government loans. However, to continue the work, we will need investments."

The mine owners, above all, want the creation of a centralizing and specific organization for coal like the National Petroleum Council, for example. Today three ministries are directly and indirectly involved with coal.

3908

CSO: 3001/41

IMPORTED GAS FROM BOLIVIA MAY BE ENERGY SOLUTION

Sao Paulo O ESTADO DE SAO PAULO in Portuguese 13 Nov 81 Special Energy Supplement
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[Text] Brazil could save 126,000 barrels of petroleum daily and spend 20 percent less on energy if it were to import natural gas from Bolivia and Argentina. The purchase would represent a reduction of 45 percent in the consumption of fuels derived from petroleum and would reduce pollution in Greater Sao Paulo by 30 percent. Argentina offers 8.5 million cubic meters per day and Bolivia 11.3 million. Interest has existed for more than 30 years, but it was only three months ago that PETROBRAS [Brazilian Petroleum Corporation] and the Ministry of Mines and Energy began to think more seriously on the subject with the creation of the National Gas Plan Task Force by the Ministry of Mines and Energy.

There are obstacles which affect the deal: political instability in Bolivia, prices--the Bolivian gas pipeline costs \$1.5 billion and the Argentine \$2 billion, enough to buy 20 years of supplies--and indecision: who will be the supplier and what will be the route of the pipeline. PETROBRAS wants the pipeline to enter the country at Foz do Iguacu, while Sao Paulo and Rio Grande do Sul technicians propose passage through Uruguaiana so as to make use of national coal produced along the line in Rio Grande do Sul and Santa Catarina. In the Secretariat and in the Sao Paulo Metropolitan Gas Company, another reason is indicated for indecision: Is PETROBRAS interested even if it has to lower its refining activity by 126,000 barrels per day?

The latest estimates, if it were not for the problems, are that the importing of this natural gas would be a good business for Brazil. Studies reveal that the savings of 126,000 barrels of petroleum per day would represent, not only a step in the right direction toward reducing the deficit in the balance of payments, but a reduction in the costs of many products.

If these gas pipelines were now operating, they would now be substituting for 45 percent of the consumption of fuel oil and liquified petroleum gas in the central-south regional of the country alone. In addition to substituting for fuel oil in several industrial sectors--iron and steel making, the manufacture of cement and glass, among others--and in residential use, that energy would cost nearly 20 percent less than petroleum.

If the Ministry of Mines and Energy believes the deal is worthwhile and opts for the purchase of natural gas, the industrialists would not have to bear great expenses to be able to use the product. To modify the system, it is enough to substitute the injector nozzle of the boiler.

Natural gas today represents 20 percent of world energy consumption. However, in Brazil the percentage is very small; it does not exceed .5 percent, which justifies importing it, according to Roberto Hukai. Brazilian reserves are small. According to an evaluation made in 1979, Brazil has 45 million cubic meters, which is the equivalent of 41 billion tons of petroleum [as published].

"Since we have to depend on foreign sources, it is better to depend partially on Latin American than on the Middle East," says Hukai. "That supply appears to me to be more reliable."

Controversy

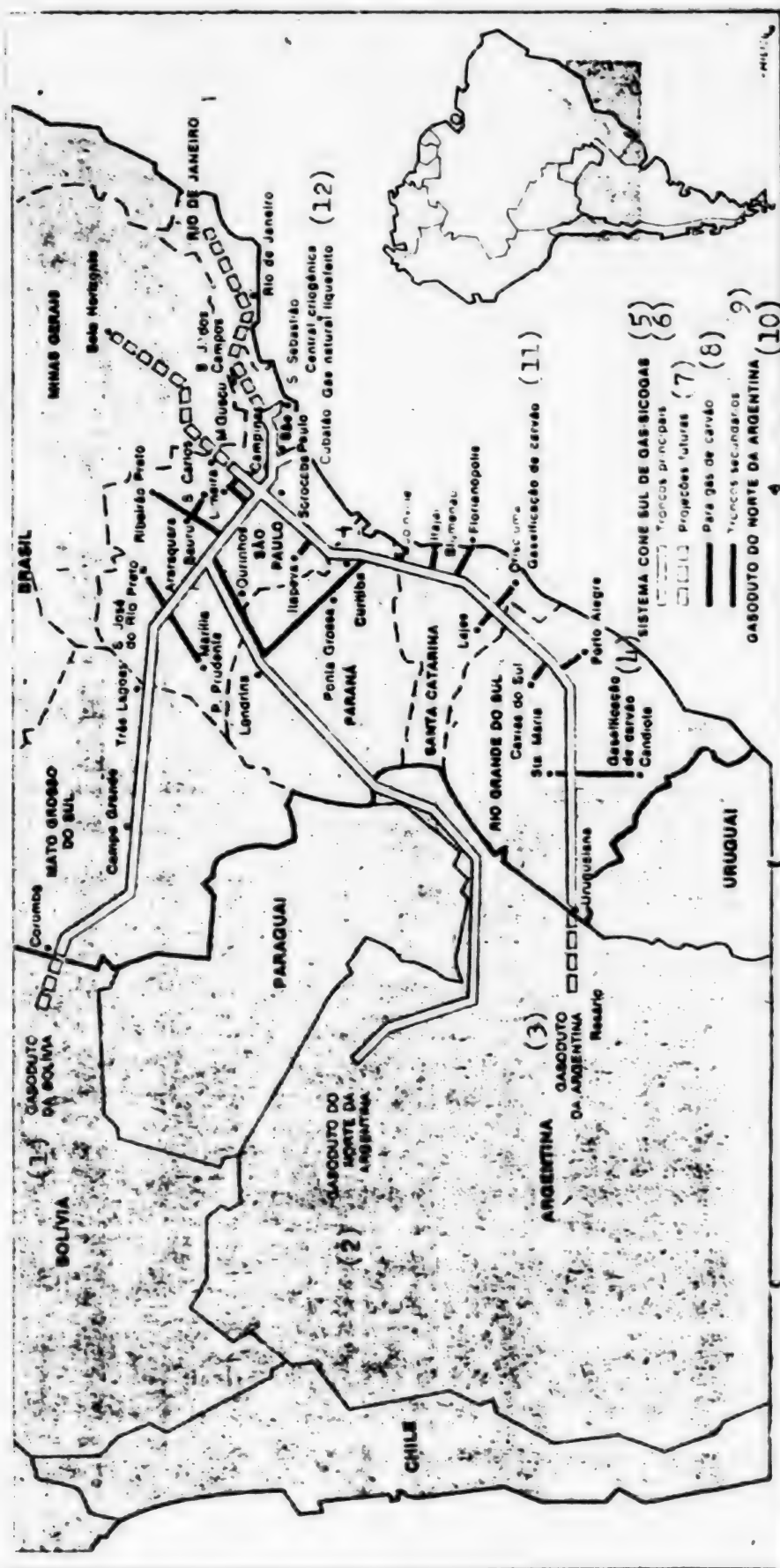
The Argentina Government has already made it clear that it would not like to divide the supply of gas to Brazil with Bolivia. He suggested to the Brazilian Government that its natural gas be carried by two different gas pipelines, one in the north, entering Brazil at Foz do Iguacu--this gas would be distributed to the large centers--and one in the Center-West near Neuquen, entering Brazil at Uruguaiana.

However, the Secretariat of Industry, Commerce, Science and Technology of the state of Sao Paulo is directly against the suggestion of the Argentine Government. It believes that in case this were to happen, Brazil is going to pay for two lines coming from the same source. He says that although its reserves are large, Argentina is still importing 4 million cubic meters of natural gas from Bolivia through the gas pipeline which passes through Santa Cruz de la Sierra.

Between the two choices, that of the entry through Foz do Iguacu or Uruguaiana, the governments of Rio Grande do Sul and Santa Catarina would undoubtedly choose the latter. Despite the length of the pipeline on the Brazilian side being less from Foz do Iguacu (1,300 kilometers compared to 1,600 from Uruguaiana), the gas pipeline to Foz do Iguacu from the Argentine side is considerably longer, increasing the price of gas at the border.

There is also another reason why the governments of Rio Grande do Sul and Santa Catarina counsel entry of natural gas through Uruguaiana: Southern coal, already gasified, would be added to the pipeline, increasing its market considerably.

Meanwhile, it has been learned, PETROBRAS and CONGAS [expansion unknown] are opposed to the execution of this project (Uruguaiana) because of the length of the pipeline in national territory. It is even said that because it is a refiner, PETROBRAS is not absolutely interested in using natural gas as a fuel because its profits would be considerably smaller compared to those obtained from refining petroleum.



Proposals for the construction of gas pipelines

Key:

1. Gas pipeline from Bolívia
2. Gas pipeline from northern Argentina
3. Gas pipeline from Argentina
4. Coal gasification
5. Southern Cone Gas System--SICOOGAS
6. Main trunks
7. Future extensions
8. For coal gas
9. Secondary trunks
10. Gas pipeline from northern Argentina
11. Coal gasification
12. Cryogenics plant-liquified natural gas

SICOGAS

Created almost a year ago by the Secretariat of Industry, Commerce, Science and Technology of the State of Sao Paulo, the Southern Cone Gas System (SICOGAS) foresees the use of Brazilian coal gas, natural gas from Argentina and Bolivia and liquified gas from Chile and Nigeria. Osvaldo Palma, the secretary, describes the system as a policy of energy regionalization capable of substituting for the equivalent of 350,000 barrels of petroleum daily.

In answer to a request from the Brazilian Government, a California company, Fluor Corporation--at the request of the AID and the U.S. Department of Energy--is preparing a technical-economic study on SICOGAS, evaluating all its possibilities in the practical field.

In addition to being a part of an overall program authorized by Minister Cesar Cals for the use of fuels in the next 20 years, SICOGAS seeks to support the governments of Santa Catarina and Rio Grande do Sul, opening new markets for coal produced in those two states in the industrial centers of Parana and Sao Paulo.

Technological feasibility studies for the construction of the coal gasification system and gas pipelines in the southern region were initiated last month and the Fluor Corporation estimates that they should be ended around the middle of June next year. This study required expenditures of around \$620,000, of which \$500,000 were provided by the U.S. Department of State.

8908

CSO: 3001/41

TECHNOLOGICAL RESEARCH INSTITUTE DEVELOPING ENERGY PROGRAMS

Sao Paulo O ESTADO DE SAO PAULO in Portuguese 13 Nov 81 Special Energy Supplement
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[Text] Since 1971 the Technical Research Institute, IPT, has been developing the Energy Program in Sao Paulo. That program is reinforced by the activities of the Sao Paulo Power Company--CESP--and by the Secretariat of Industry, Commerce, Science and Technology. The overall work is the search for alternate energy sources.

According to Israel Gochnarg, coordinator of the Alternate Energy Source Program, the study made by the IPT on biomasses, for example, made possible the publication of 65 manuals, distributed to the rural workers of the entire state of Sao Paulo, containing explanations on the types of soils of each region, the availability of crops for energy purposes, how to plant, how to store products and how to transport them if necessary. The manual will shortly be complemented by a pamphlet prepared by CESP in which all the details for the construction of digesters will be explained and recommendations made on the use of the available raw materials in each region.

The IPT is perfecting low-cost equipment to be used in small distilleries. The objective is to produce alcohol at a low cost with local manpower so as to provide supplies for each region. One innovation by the IPT for the use of wood as a source of energy calls for the use of waste, leaves and branches. Together with the CESP they are developing Project 500, which proposes producing 500 kilowatts of electric power through the gasification of wood. The second part of the plan expands the target to 1,000 kilowatts. In the area of vegetable oils, the institute has already ended a preliminary study on the small-scale production of fuels from soybeans, peanuts, sunflowers, castor oil plants, and rape seed, pure or mixed with alcohol. The project is being financed by the Secretary of Industry, Commerce, Science and Technology.

"Vegetable Cow" is the name Israel Gochnarg gives to the babacu [oil palm], which was studied because of the possibility of its economic use. "Nothing is wasted from it," declares the technician, saying that in addition to the nuts, which provide an oil of excellent quality "even used for pharmacologic purposes," the remaining parts are also used as perfect substitutes for imported industrial charcoal. More than just building a pilot unit with the capacity for converting 300 kilos of raw material per hour into charcoal, a study was made for the development of "a tree of products and byproducts which may be obtained from the nut of the babacu."

That is not all. According to Israel Gochnarg, a project is underway for installing a unit for making charcoal out of the endocarp of the babacu nuts on barges. It would have a capacity for processing 10,000 tons of babacu per year. That novel mobile plant, according to its creators, would use all the incondensable gases as a source of power. Daily production of charcoal foreseen varies between eight and 10 tons. The barge would be supplied with raw material at collection points located along the Parnaiba River on the stretch between the municipalities of Luiziania and Uniao in the state of Piaui.

The IPT concluded its studies on the installation of mini and micro hydroelectric powerplants with the objective of making the use of small waterfalls for generating power economically and technologically possible. The results are already being used by the Secretariat of Industry, Commerce, Science and Technology, which by 1990 intends to generate more than 6,000 megawatts, it was reported by Secretary Oswaldo Palma. Before that, which means by 1983, "another six medium-size powerplants, which should produce 3,850 megawatts, will be completed," he adds.

According to the secretary, the other four hydroelectric plants, "each one with a capacity for generating 2,000 megawatts," which should be completed soon, will represent the end of the capacity for hydroelectric power generation by the rivers of Sao Paulo. Without counting the mini hydroelectric plants, "We shall be generating another 14,000 megawatts in the state, 32 percent of the total demand for electric power in Brazil, he announced. The alternatives after that time will rest with the Peruibe I and II nuclear powerplants.

Three years ago the IPT installed the first solar energy collectors in public buildings, continues the coordinator of the Alternate Energy Source Program. Today, studies are aimed at establishing norms and standards for the components of those collectors so as to make them cheaper. Just as with biodigesters, those studies should be done by the CESP.

Shale and peat were studied and evaluated by the IPT, with work performed in the Vale do Paraiba Region. The objective was to determine the technical-economic feasibility of their use as an energy source on an industrial scale. The use could be in three ways: directly in the boilers, by means of gasification and also by distilling for obtaining fuel oil. The technology, according to the IPT, is already available to private enterprise.

Alcohol-chemistry is another sector which has had special studies made on it by the IPT of Sao Paulo; "Theoretically, everything that can be done with petroleum can be done with alcohol," declares Israel Gochnarg, saying that it is the first step in the introduction of the "national alcohol chemistry" concept.

Another project of the Secretariat of Industry, Commerce, Science and Technology is the solar house. According to Oswaldo Palma it is a laboratory for testing solar equipment, which will produce all the electric power required by a "sophisticated" house. The IPT will install that laboratory at the site of the Energy and Nuclear Research Institute in University City here in Sao Paulo.

Energy in Raw Materials

Raw material (1 ton)	Fuel Produced	Yield in percentage	No. of liters	Approximate cost (cruzeiros)
Wood (eucalyptus)	Methanol	75	750	13 to 18
Babacu husks	Methanol	70	700	10 to 16
Coal (Rio Grande do Sul)	Methanol	35	350	13 to 20
Water lilies	Methanol	20	200	10 to 16
Urban garbage	Methanol	18	180	10 to 18
Coal (Rio Grande do Sul)	Synthetic oil	15	150	26 to 30
Coal (Rio Grande do Sul)	Diesel and synthetic oil	15	150	28 to 32
Shale	Oil	9	90	35 to 40
Sugarcane	Alcohol	7	70	31 to 32
Liquid sewage	Gas	2.4	24	-- --

8908

CS0: 3001/41

USE OF BIODIGESTERS IN RURAL AREAS WILL INCREASE

Sao Paulo O ESTADO DE SAO PAULO in Portuguese 13 Nov 81 Special Energy Supplement
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[Text] As of two years ago, biodigesters began to acquire more and more importance in the discussions about alternate energy sources for the rural area. Based on this observation, technicians of the CESP [Sao Paulo Power Company] decided to study and develop several models at their experimental station in Corumbatai. The Indian, Chinese, Canadian and the polyethylene model designed by the Brazilian Navy are all being tested there now. The results of all those tests will be revealed in a pamphlet which should be delivered to rural workers by CESP officials responsible for measuring the amount of electric energy used. This is the Eletrocampo Project [Rural electrification project].

In the Indian and Chinese models, wastes of any type, as long as they are organic, are placed in a closed receptacle with little oxygen. In that environment of little air, microorganisms begin to decompose the material, producing what is known as "biogas." According to Carlos de Mello Figueiredo, liquified petroleum gas has 3,200 calories per cubic meter. The same amount of biogas has 4,500 calories. The waste, which is expelled at the end opposite to the one where the organic material was introduced, in addition to being dry and odorless, is an excellent organic fertilizer.

The Canadian model is the most sophisticated. The system is the same, with one difference: it heats and stirs the deposited material. The result is an acceleration in the process of digestion by the microorganisms, which therefore produce more gas and fertilizer in a shorter time. The model developed by the Navy is different than the rest because it inflates like a gas balloon. It has an advantage: It is easy to transport and needs no civil construction.

The use of water lilies which are "a real pest in still waters," according to Plinio Ugo Meneghini dos Santos, is being studied with close attention. Plinio is in charge of the Aguape [water lily] Control and Use Project in the CESP. The "pest" primarily affects hydroelectric powerplants, where they create regular islands and cause problems by causing blockages in equipment. They are also the catalyst for the virus of schistosomiasis.

To remove the water lilies from the dams, technicians reached the conclusion that it is better to gather as many of the plants as possible through the use of two vessels dragging an enormous net. Afterwards the plants would be removed to conveyor belts to places where biodigesters will be installed. The equipment is still lacking, meanwhile, however, a pilot digester is being installed in Americana, Sao Paulo, the objective being to build an industrial prototype.

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SURPLUS HYDROELECTRIC POWER TO BE STORED IN TANKS

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[Text] A tank capable of storing extra power generated by a hydroelectric plant during times of floods for an indefinite period and without the slightest danger of waste is the result of the Project for the Storage of Hydrogen in Metallic Hydrides, carried out by the University of Campinas jointly with the Sao Paulo Electric Power Company [CESP]. Technicians believe the process may be used in the transportation network throughout the country soon.

The storage of hydrogen in hydrides, explains Carlos Mello Figueiredo, consists of a tank which contains a metallic beam made of iron-titanium or magnesium-nickel. "The internal surface is porous," explains Figueiredo, and it is precisely in those pores that the hydrogen in a gaseous form is deposited. The process for obtaining that hydrogen is accomplished by only one method: electrolysis. This means that an electric current generated during a flood period in a river which provides the water for a hydroelectric plant, is passed through a quantity of water, releasing oxygen on one side and hydrogen on the other.

Figueiredo believes that the ideal thing would be to use that resource on the railroads and waterways where useful weight is not important. The release of stored hydrogen "is simpler than is thought," says the CESP technician. All that is necessary is to heat the metallic hydride, which immediately releases the element it contains. According to Figueiredo, in addition to having a better hydrogen calorie retention property than the conventional liquid form, gaseous retention in hydrides is infinitely safer, cheaper and easier to work with. The system of storage also can generate electric energy directly, using the process which is opposite to that of hydrolysis.

At this time there is a plant which converts electricity into hydrogen in the University of Campinas. If there is no reduction in funds, it should serve as the basis for a new unit, this of the size of an industrial prototype at a place still to be selected. "It will probably be at Corumbatai also," hazard the CESP technicians.

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GARBAGE UNDER CONSIDERATION AS ENERGY SOURCE

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[Text] The conversion of garbage into an energy source is the objective of the agreement signed between the Prefecture of Sao Paulo and the Sao Paulo Power Company [CESP] last February. In addition to producing more electric power, there is another advantage to that project: It cuts down the costs of transporting the garbage outside the city.

The Prefecture now collects 8,000 tons of garbage per day and it is placed in sanitary landfills, which are becoming more scarce and distant every day. A part of that garbage is being converted into organic fertilizer by two plant with a capacity of 800 tons per day, while another 800 tons are burned in three incinerators, without any use being made of the heat energy from them.

There is already a project for the installation of three garbage-fueled thermo-electric powerplants for Sao Paulo, the first would be in Santo Amaro near the Piratininga plant, which will facilitate the use by CESP of the electric power produced there. The other two would be installed on the banks of the Tiete River.

The present 8,000 tons of garbage are distributed among two composting plants, that of Sao Mateus, which produces 150 tons of organic compost per day, and that of Vila Leopoldina which produces 220 tons; four sanitary landfills, which are located off Bandeirantes Highway, Vila Albertina, Sapopemba and Santo Amaro, and three incinerators, two of 300-ton capacity of garbage per day and one of 150 tons.

The fertilizer produced by the garbage is sold at prices which are much lower than other organic composts to farmers of the entire state and in the northern part of Parana. The methane gas produced by the garbage, which is placed in layers in the sanitary landfills, is being used by COMGAS [expansion unknown] in an experimental phase and it is already being channeled to 350 houses in a residential development in Raposo Tavares. Its combustion rate is better than that of the normally used naphtha gas but up to now it has not been possible to store it in bottles. Moreover, the amount of garbage foreseen for this decade will require a space of at least 7 square kilometers, which will raise problems in urban areas.

There are other forms of the use of garbage, for example pyrolysis, which creates a type of oil, also under study abroad. The solution of incineration with the production of steam or electric power was adopted a century ago in Europe and more recently in the United States. Here, CESP studies on the use of garbage as another energy source began in 1977. By 1983 it is expected that a good solution for that problem will be found since by then some of the sanitary landfill areas in Sao Paulo will be exhausted.

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SOLAR ENERGY TO BE USED FOR AGRICULTURAL PURPOSES

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[Text] Solar power is already becoming one of the most important alternate energy sources in the country. Expertise in improving the use of that natural energy source is increasing. The best example is near the Sao Paulo capital in the municipality of Corumbatai, where the CESP [Sao Paulo Electric Company] has an experimental technology station.

There is already a demonstration unit there for drying grain and an irrigation pump, both powered by solar energy. A short time ago the company concluded a plan for a survey of the intensity of the sun's rays throughout the entire state. That survey will be initiated when imported equipment is installed in 16 of the CESP hydrometeorology stations. That will be the first step for the large-scale use of the energy from the sun.

There are two processes for obtaining and using solar energy: thermal and photovoltaic. The thermal process works this way: The absorption of the heat of the sun's rays is done by means of thermal collectors, which heat the air. The grain dryer operates from solar heat, receiving the heated air pumped to it by fans. The photovoltaic system uses a photovoltaic cell which direct transforms radiation into electric energy. Technicians of the University of Campinas, together with those of CESP, have developed a completely national model.

"The objective is to arrive at a technology which will decrease costs in obtaining solar energy," explains Nelson Luiz Tarricone, who participates in the State Energy Study and Development Program. He said that even so it is already economically feasible in regions where there is no electric network. Tarricone foresees that no later than by 1990 a cost of operation lower than that of conventional electric power will have been attained.

However, as always, Brazilian scientists complain that there is an almost complete lack of support by the government for research. Carlos de Meloo Figueiredo says that private companies in the United States invest as much as 5 percent of their revenues in research. Added to government subsidies, this comes to a respectable sum. "In Brazil, the investments in that field do not reach one one thousandth of the GNP," says Figueiredo and he adds that it is unfortunate that an area as important as that of research is neglected, particularly in a country with the potential of Brazil.

In addition to all that, there exists a "built-in incredulity" with respect to technological innovations, says Mello Figueiredo. He cites an example: A company from the northern part of the country, which already industrially produces a hydraulic pump powered by solar power, offered its product to SUDENE [Superintendency for the Development of the Northeast], which simply did not even want to test it.

According to figures of the Foundation for the Development of Engineering Technology, FDTE, a hectare of sugarcane produces 17,830 megacalories per year. Ethanol provides 28,450. That same hectare of soil receives in that same period 15⁹million megacalories. With available technology at this time, there can be a 30-percent use made of it. Mello Figueiredo once more mentions the advantages of the solar pump, one of which is the fact that it is self-regulating. This means that when the sun is the hottest (and the plants need the most water), more water is going to be pumped by the pump since it is the sun itself which powers it.

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METHANOL FROM WOOD IS POWER COMPANY PROJECT

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[Text] "The extraction of methanol, a perfect substitute for diesel oil and fuel, from wood in a process unprecedented in the world; the use of all organic substances, including the feared water lilies which foul dams, to obtain gas and also an efficient organic fertilizer; the capturing of the sun's rays, turning them into authentic generators of power for factories and homes; to draw from the air itself the chemical elements needed for the manufacture of fertilizers which are still imported in large quantities, not to speak of the audacity of deriving energy from something which everyone throws away: garbage, those are some of the 'fronts' in the war for energy efficiency," says Carlos de Mello Figueiredo, specialist in energy source research of CESP [Sao Paulo Power Company].

In 1977 the CESP ceased to be Electric Powerplants to become the Sao Paulo Power Company. According to Nelson Luiz Tarricone, manager of the Special Studies Department, that was a sign of "a reorganization, a greater orientation toward the search for new alternate energy sources." A proof of that, he says, was the creation of the vice presidency for Energy Studies and Development. Work began at that time on methanol research on the basis of conventional technology but also in the field of research and experimentation.

In that work, Professor Eduardo Sabino de Oliveira, a CESP consultant, concluded by discovering a process--the electrothermal--which aroused attention because of the low production costs it entailed. Needless to say, it was the one selected. Today methanol is obtained from the gasification of wood. "The most used wood is eucalyptus," explains Mello Figueiredo, pointing out its properties of rapid growth. "In 5 or 6 years it can already be used," in addition to the fact that it can be grown on any type of soil.

The process, explains the specialist, consists of putting the wood into the gasifier (a sealed environment with little oxygen), causing the release of gases. "There is no burning due to the lack of oxygen." Later those gases are mixed with oxygen forming "gas by synthesis" which will be turned into methanol. The oxygen added to that mixture is obtained from a unit for the separation of atmospheric air, from which nitrogen results as a byproduct. That nitrogen, in turn, is used for the manufacture of fertilizer.

After the "gas by synthesis" is obtained, continues the CESP expert, the process follows a conventional technology. At this time technicians of the CESP are studying the installation of a methane plant on a prototype-industrial scale in Jupia, Andradina, on the border of Sao Paulo with Mato Grosso.

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PLANT TO USE NITROGEN IN MANUFACTURE OF FERTILIZER

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[Text] The use of nitrogen in the production of fertilizers is the project the CESP [Sao Paulo Power Company] installed in Jupia. The objective is to decrease the shortage in the sector somewhat, deficit which in 1985 will reach 250,000 tons. In addition, there is another beneficial result in that program: It will help to reduce imports of fertilizers, which represent a large burden on the balance of payments of the country.

National production is made from petroleum byproducts and that means the spending of foreign credits. What is to be done in view of such prospects? "Use the nitrogen in the air to produce ammonia, the raw material of the principal fertilizers used in Brazil," says Engineer Nelson Luiz Tarricone. He explains that the company already has an "oxygen plant," which uses that element to gasify wood in the manufacture of methanol.

"Nitrogen, which makes up approximately 75 percent of the air in the atmosphere, is simply being cast aside," says Tarricone. He says that the process for obtaining nitrogenous fertilizers should be very cheap since the same equipment of the methanol plants will be used, as well as the surpluses of electric power generated by the hydroelectric plants during floods. Another advantage, in the hypothesis that nitrogen is used, according to Tarricone, is that it will lower the costs of electric power.

In the area of research, the most important CESP project at this time is forestry research, which is now taking place in the municipality of Jupia on the border of Sao Paulo with Mato Grosso do Sul. Seedlings of various types of timber are being selected there to be planted pursuant to all techniques learned and developed in experimental studies.

Carlos de Mello Figueiredo explains that the objective of the program is to establish "a specific technology for the establishment of energy forests." After practical studies and tests, CESP technicians, who are working in research with the help of the IPT [Technical Research Institute], selected three types of eucalyptus planted in the 50 hectares of area devoted to those tests.

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